



**A STUDY OF THE EFFECTS OF ECOLOGICAL SELF IMAGERY  
ON VIVIDNESS OF MOVEMENT IMAGERY, ACTION CONTROL  
AND PERFORMANCE ABILITY IN YOUNG BALLET DANCERS**

**DIANE VAN DER WESTHUIZEN**

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**THE AUTHOR HEREBY DECLARES THAT THIS THESIS  
UNLESS SPECIFICALLY INDICATED TO THE CONTRARY, IS A  
PRODUCT OF HER OWN WORK**

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### ABSTRACT

The study aimed to examine whether an experimental imagery intervention, which elicited ecological representations of self, was more effective in enhancing vividness of movement imagery, action control and performance ability than a conventional imagery intervention and/or that of a standard, instruction intervention. In order to test this hypothesis, a sample of 36 young ballet dancers (11-13 years) were secured from five reputable ballet schools and randomly assigned to three groups ( $n = 12$ ) for the purposes of conducting a true experiment: a standard control group, an imagery control group and an experimental imagery group.

Descriptive statistics and frequencies were conducted for all instruments used to describe and represent single variables of interest. Parametric and nonparametric statistical procedures were used to determine whether significant differences existed between the three groups for measures of vividness of movement imagery, action control and performance ability. Additional emerging relationships and trends were explored through bivariate correlational analyses, multiple stepwise regression procedures, a factor analysis as well as MANOVA and ANOVA statistical procedures.

The results of the study were varied and some interesting trends were observed. Contrary to what was expected, the results revealed significant differences across the three groups for mean difference scores of performance ability, in favour of the standard control group. In particular, the standard control group revealed positive benefits in performance ability while the imagery control and experimental imagery groups revealed deteriorations in performance ability. The experimental imagery group was found to be significantly different from the imagery control group for mean difference measures of internal vividness of movement imagery. However, the study failed to reveal significant variations in mean difference scores for action control across the three groups. Furthermore, the results indicated that external and internal vividness of movement imagery were found to be significantly correlated with performance ability for the entire sample ( $N = 36$ ) and across the two imagery groups ( $N = 24$ ) respectively. Finally, numerous significant and near-significant relationships were observed between measures of vividness of movement imagery, action control and performance ability.

The results were discussed in relation to the literature on mental imagery, ecological self, action control and development.

## **CHAPTER ONE**

### **GENERAL OVERVIEW**

#### **1.1 Introduction to the study**

The current study was aimed at developing and refining the application of mental imagery interventions in performance enhancement. The main theoretical focus was the importance of the external physical environment in self construction, and researched the effects of ecological self imagery on performance. Action control was included in self representation and its implications for imagery interventions was also explored.

Perry and Morris (1995) acknowledge that mental imagery is a rich and complex phenomenon. Research into imagery is diverse and is characterised by a long history of debate between different but equally intuitively appealing hypotheses (Solso, 1979). Although the effectiveness of imagery in sport is well documented, the detailed nature, underlying mechanisms and processes of imagery are not well understood (Perry & Morris, 1995). According to Basson (1997), most of the research on imagery has focussed “primarily on cognitive-motor links in imagery with less attention given to variables relevant to the context of imagery generation and application such as self and interpersonal schemas” (p.1). In particular, Basson argues for an ecological self representational perspective as one of the many context variables that may account for the efficacy of mental imagery in sport and which is of central importance to this study.

The discourse of the construction of the self has become increasingly important in many academic disciplines including psychology and should therefore be considered as a further dimension in sport psychology imagery interventions. This new emphasis is reflected in the revisionist approach to traditional psychoanalytic theory where there is a shift of attention to the “vicissitudes of the self rather than drives” (Suler, 1996, p.1). Neisser (1995), one of the main eco-theorists, suggests five forms of self knowledge: two perceptual forms, namely, the ecological self and the interpersonal self, and three non-perceptual mediums, namely, the conceptual self, the temporarily extended self and the private self. The first of Neisser’s types of self-knowledge, the ecological self, has most relevance to this study, and may be defined as the information of self gained directly from perceptual information of the immediate physical environment.



Neisser's concept of the ecological self is based on James J. Gibson's (1996) ecological approach which was itself seminal in developing a more systematic, general ecological psychology (cited in Greeno, 1994). In Gibson's ecological approach, he developed an interactionist view of perception and action, at the heart of which lies the reciprocity between perceiver and environment. The central concept underlying Neisser's concept of the ecological self is Gibson's theory of affordances. All affordances are conceptualised relations between the perceiving subject and the perceived environment. This relationship is sometimes referred to as the "animal-environment fit" (Warren, 1994 in E J Gibson, 1992 cited in Neisser, 1992, p.218). As mentioned, self representation as a context variable in imagery research and application has received little attention, especially ecological self representation. It is proposed that an imagery intervention with affordance saliency can enhance and reinforce the "animal-environment fit" by way of eliciting ecological representations of self. According to Basson (1997), the importance of Neisser's (1992) theory is the promotion of skill development and performance in general (cited in Basson, 1997). This is further upheld by the "natural physical" movement which postulates that motor skills are eco-dependent (Turvey, 1992).

This study also seeks to explore the possible relationship between self representation and action control processes in that they are both cognitively based attempts to explain a relationship between the sense of control one feels over the outcomes of an action in relation to the performance of that action. According to Geen (1995), if the task is difficult and the person feels a sense of control over the outcomes of an action, then the person may adopt an action orientation. The person who is action orientated processes mainly goal-related information and also tends to experience emotional and affective states that direct and support meaningful action. Thus, another important aim of this study was to examine how the activation and representation of the ecological self through the administration of an ecologically relevant imagery intervention could enhance the self-regulatory mechanisms which mediate the formation and enactment of intentions. By focussing on ecologically relevant environmental cues, the sports person could be encouraged to gain a performance advantage through enhanced action control strategies by better approximating the "animal-environment fit". Therefore, this study proposes that action control strategies and motor skill performance will be interactively precipitated. This would lend more validity to the relevance of self representation as a context variable in imagery interventions.

In order to test this hypothesis, two group imagery interventions were conducted with one control group given minimal standard instruction for a particular motor task. The first imagery control intervention employed conventional relaxation and imagery strategies. The experimental imagery intervention aimed at eliciting ecological self images by instructing the “perceiver” to image the affordances offered by their specific performance skill domain. In this study, a sample of 36 young ballet dancers (aged between 11- 13) were required to execute a single *pirouette en dehors* (single turn towards the back foot) in a studio specifically designed for expert movement. During the administration of the experimental imagery intervention, the sport psychology clinician (SPC) specifically focussed on shapes, size, boundaries and edges as potential interactive affordances and/or constraints of the “perceiver’s” domain. Here, emphasis was simultaneously placed on the potential interactive abilities of the “perceiver” to facilitate ecological self construction, action control and expert motor skill. Furthermore, it was anticipated that the ecologically relevant imagery intervention would enhance the ability to image movements more vividly relative to the other two groups.

In the spirit (rather than the deed) of Gibson’s direct perception theories, it was hypothesised that the “perceiver”, through the medium of an ecologically relevant imagery intervention, would become more attuned to variables and invariants of interactive information, thereby better approximating the envisioned “animal-environment fit”. It was proposed that the experimental imagery intervention, which aimed at eliciting ecological representations of self, would be more effective in enhancing vividness of movement imagery, action control strategies and performance ability, than conventional imagery generation. Therefore, in this study, the writer will be putting both Gibson’s and Neisser’s ideas to use which, to the best of the writer’s knowledge, was never anticipated by them but has been by Turvey (1992). Having said this, the writer does not intend to distort the actual claims about ecological self representation in any way; rather merely apply and extend them in principle.

## 1.2 Rationale for the study

The topic under investigation is important for a number of reasons:

- (a) The principle rationale for utilising ecological self principles in the context of imagery generation and application is to assist the sports person in gaining a performance advantage through the use of better vividness of movement imagery and action control strategies. Thus, the recognition of



an ecological perspective in the field of imagery research may have potential heuristic value for sport psychology research and practice. Furthermore, publication of such research will relate strongly to the interests and ongoing work of the supervisor of the current study.

- (b) Although the value of Gibson's (1979) ecological approach has been recognised by some cognitive scientists (e.g. Moran, 1996; Neisser, 1992), it has not been widely adopted in psychology (Vincente & Wang, 1998), apart from the seminal work of Turvey (1992). However, the application of ecological self principles to mental imagery may provide important insights that may lead to the improvement of existing mental training procedures.
- (c) The effectiveness of imagery in sport is well documented (Cox, 1994; Perry & Morris, 1995; Solso, 1979; Suinn, 1993 & Suler, 1996). However, it may be argued that more attention needs to be given to the variables relevant to the context of imagery generation and application (Basson, 1999a). In this study, the importance of ecological self representation (Neisser, 1992) was recognised and explored as a possible context variable in the field of imagery research. It is hoped that such research will provide further clarification of the unknown, but rich and complex processes of imagery in sport, and in particular, of action control and performance.
- (d) According to Kuhl and Eisenbeiser (1986), further research is needed on the various structural aspects of action control. Although studies provide some preliminary information as to how action oriented subjects maintain a high degree of action control, little is known about the intervening processes. Therefore, this study may provide important information as to the strategies an individual may use to ensure that an intended action will be carried out.

### **1.3 Previous work in this field**

Cognitive models in sport psychology have recently incorporated James J. Gibson's (1979) theory of direct perception and affordances, and the allied field of ecological psychology. Research of this nature assumes an ecological approach to the psychology of human movement skill and development (Greeno, 1994; Moran, 1996; Neisser, 1992; Turvey, 1992 and Vincente & Wang, 1998).

Research on the effects of ecological self representational imagery on self-efficacy and skill acquisition was conducted by van der Westhuizen and Basson (1997). Results proved interesting and varied. Correlational measures between self-efficacy and actual performance ability revealed that the experimental imagery group (ecological self imagery) significantly underestimated their actual performance ability by 16.78%. These results were compared with the two control groups which overestimated their actual performance ability by 3.19% (imagery) and 7.42% (control). It was proposed that a *refinement* and a *extension* (see below) of the abovementioned study be conducted with the aim of better understanding the extent to which domain-specific contexts, inherent in ecological self imagery, are able to affect performance skill:

- (a) *Refinement*: The study aimed to refine the sampling and experimental procedure by better controlling for extraneous and other such variables. With respect to the sampling procedure, this study attempted to secure a more homogeneous sample of subjects with respect to age, skill and level of ability. Furthermore, the experimental procedure incorporated both pre- and post-intervention assessment measures to control for variations in vividness of movement imagery, action control and performance ability across the three groups.
- (b) *Extension*: An important extension was proposed for the study. Kuhl's (1985) concept of action control was considered as an important determining variable in the imagery-performance relationship. By highlighting relevant environmental information during an imagery intervention, it is predicted that the perceiver will feel a greater sense of control over the outcomes of her/his action (see section 2.3).

## CHAPTER TWO

### LITERATURE REVIEW

#### 2.1 Mental imagery

##### 2.1.1 Application in performance skill

Defining mental imagery has been a contentious issue in sport psychology and several definitions of the term have been advanced. However, Richardson (1969 cited in Murphy & Jowdy, 1992) succeeds in addressing several key issues concerning the nature of imagery:

*Mental imagery refers to all those quasi-sensory and quasi-perceptual experiences of which we are all self-consciously aware and which exists for us in the absence of those stimulus conditions that are known to produce their genuine sensory or perceptual counterparts (p.222).*

Imagery is also cited as one of the three systems of representation for processing information and encoding memories, the others being the lexical and the somatic systems (Suler, 1996). According to Cox (1994), although a great deal of research has been published relative to the effectiveness of imagery in sport, sport psychologists still know very little about why this strategy is effective. Therefore, it may be argued that more systematic and controlled research is needed to better understand the detailed nature, underlying mechanisms and processes that account for the efficacy of imagery or other techniques that might aid in its operation (Feltz & Riessinger, 1990; Perry & Morris, 1995).

A number of theories have been proposed in an attempt to understand the mechanisms whereby imagery enhances the performance of physical skills, and affects self perceptions and emotions (Perry & Morris, 1995). According to Suinn (1993), at least four theoretical formulations have been advanced: (1) the psychoneuromuscular theory or ideo-motor approach; (2) the symbolic learning theory or cognitive approach; (3) the attentional-arousal theory or preparatory set approach; and (4) the bio-informational theory or information processing approach. Cox (1994) argues that the best theory might be one that is eclectic in nature.

It is this diversity of mental imagery research that allows space for this study's point of entry. Basson (1997) argues that most of the research on mental imagery has focussed "primarily on cognitive-

motor links ... with less attention given to variables relevant to the context of imagery generation and application such as self and interpersonal schemas” (p.1). In particular, Basson (1997) argues for an ecological perspective of self representation which may have “potential heuristic value for sport psychology research and practice” (p.4).

### **2.1.2 The concept of self and ecological self representation**

Suler (1996) explores the function of mental imagery in the development, maintenance and transformation of self, but stresses its interrelation with the lexical and somatic systems of representation:

*... all three systems operate as an integrated network, providing a cross-coding and confirmation of subjective experience that results in enhanced coherence of self structure*  
(p.658)

Thus, the imagery system serves an important function in the structuring of experience and the integration of a sense of self. This lends credence to mental imagery practice being able to tap into a self schema containing “various levels of self-knowledge and self-other knowledge arranged hierarchically” (Basson, 1997, p.3).

According to Basson (1997), research on mental imagery has generally given little attention to the concept of self representation, as a context variable in imagery intervention. Imagery is the guardian of psychological structure, affirming and concretizing representations of self and object or environment (Suler, 1996). Imagery interventions could therefore function to both enhance and draw from these internal self structures. It is hypothesised then, that imagery interventions have the potential to facilitate harmonious interaction between self experience and the environment, thus mobilising the optimal performance capacities of a sports person. In particular, this study is based on the importance of ecological self representation as a mediating variable in the imagery-performance relationship.

Recently, studies have focussed on the variables that might mediate the effectiveness of the use of imagery as a mental preparation strategy (Gordon, Weinberg & Jackson, 1994). One such variable,

which this study proposes to investigate, is the use of the external physical environment in self construction and representation. In particular, Basson (1997) argues for an ecological self representational perspective as one of the many context variables which may account for the efficacy of mental imagery in sport and which is of central importance to this study.

In order to conduct such research, this study will draw heavily on Ulric Neisser's (1988, 1991, 1992, 1993, 1995) concept of the ecological self. Ulric Neisser's (1995) concept of the ecological self is primarily based on Gibson's interactionist theories of direct perception. From his theories of direct perception, James J. Gibson developed an ecological approach which was itself seminal in developing a more systematic general ecological psychology (Greeno, 1994). James J. Gibson (1979) was the first theorist to insist that perceiving the self is an inevitable counterpart of perceiving the environment. Thus, Gibson's ideas are basic to the notion of an ecological self (Neisser, 1993). The concept of an ecological self has most relevance to this study in that information specified for ecological self awareness is directly perceived from the immediate physical environment. By highlighting the salient interactive possibilities between perceiver and environment during the administration of an ecologically relevant imagery intervention, it is proposed that perceiving will become more economical and actions more skilful and controlled. The underlying mechanisms of this process will be elaborated upon.

## **2.2 J J Gibson's affordance theory**

### **2.2.1 Perceiving affordances**

According to Neisser (1993), what we perceive is the world - its layout, the objects, the transformations of those objects and what opportunities for interaction they afford. Such an enterprise must happen naturistically. As agents move freely through their ordinary environment, many kinds of information specify where they are, how they are moving, what they are doing, what they might do and whether an action is their own or not.

In Gibson's ecological approach, he developed an interactionist view of perception and action, at the heart of which lies the reciprocity between perceiver and environment. The central relations of reciprocity underlying this system are that of affordance, constraint and ability (Greeno, 1994). According to Adolph, Eppler and Gibson (1993), perceiving an *affordance* is always a dual process:

what is perceived is what the environment affords for action. Describing the information that underlies perception must take into account both the environmental supports for the affordance and the capacities for action of the agent. Therefore, one must describe the animal's environment in terms of the support for the animal's actions. Furthermore, one must describe the "propensities and capacities for action that make the supports appropriate" (E. J. Gibson, 1992 cited in Neisser, 1992, p.218). Warren (1984) describes this system as a "dynamic animal-environment fit" (cited in Neisser, 1993, p.32). Within this dynamic, interactive system the agent is constrained by her/his environmental niche and the niche is fitted to and acted upon by the agent (Gibson, 1993). Therefore, affordances also act as *constraints* on a person's abilities and actions. Constraints act to regulate and limit our active engagement in situations. The result is that one's *abilities* and actions arise out of an intuitive (automatic and unconscious) attunement to these constraints (Greeno, 1994; Basson, 1999a, p.1). This could be the slope of the wall of a squash court, the surface of the floor needed for elevation, the four corners of a room, the resistance of water during a swimming stroke (Basson, 1999a). Attunements to constraints also play an important role in skilled activity (Greeno, 1994; Vincente & Wang, 1998). For example, an expert performer such as a dancer, is attuned to subtle and complex constraints that relate to changes in the direction of her/his body motion with the simultaneous transformation of her/his spatial environment.

Affordance perceptions serve another function relevant to this study. By extending affordance perceptions, it is predicted that the perceiver will feel a greater sense of control over the outcomes of her/his action. By focussing on relevant affordance cues, the perceiver will be encouraged to process mainly goal related information. Therefore, an action orientation may be aroused by a motivational tendency to control cognitive activities in such a way that supports and directs meaningful action (Kuhl & Eisenbeiser, 1986). Thus, the perceiver could gain a performance advantage through enhanced action control strategies by better approximating "the animal-environment fit". It was therefore hoped that the action control measures of this study might reflect the beneficial effects of an affordance salient imagery intervention which aimed to extend ecological self awareness. These effects should be translated into improved performance skills (see section 2.3).

### 2.2.2 The ecological self: Location and movement

Ulric Neisser (1995), who draws heavily on Gibson's interactionist theories of direct perception has defined the ecological self as:

*the individual situated in and acting upon the immediate physical environment. That situation and activity are continuously specified by visual/acoustic/kinaesthetic/vestibular information* (Neisser, 1995, p.21).

According to Butterworth (1995), it is this co-perception of self interacting with the environment which forms the foundations of the ecological self (cited in Bermudez et al, 1995). According to Gibson (1993), the self is a kind of interface between the agent and the environment. The result is a self-relational representation of the environment because the self both shapes this ecological system and is a reflection of it. In this study, the author will use Neisser's psychological concept of the ecological self: the self directly perceived as it moves through, acts upon, and experiences its immediate environment (Fraleigh, 1993).

This focus raises questions about the general nature of the perceptual input specifying our perception of the world as well as the information underlying one's self knowledge of one's body position within a specific context. For Neisser (1991), the most important modality for self-perception is probably visual. Of course we also experience our movements kinesthetically, but research has shown that kinaesthesia, touch and proprioceptive abilities are readily "calibrated and recalibrated by vision" as the bodily self moves and grows (Neisser, 1995, p.24). Vision, therefore, provides rich and dependable information about the environment and the self. According to J J Gibson's theory of affordances, the perceiver through his visual system, aligns his movements to the optical flow of information as the interactional possibilities with the environment are perceived. However, it is important to realize that self-knowledge about body position and movement is potentially available and integrated through multiple input systems. Moreover, the distinction between perception and action can only be made at a theoretical level of analysis; in ordinary behaviour they are inseparably fused. This is because we perceive ourselves as embedded in the environment, and acting in relation and respect to it (Neisser, 1988). Therefore, one needs to understand how the visual and action systems are coordinated together as the interactive possibilities of the environment are perceived



(Neisser, 1991, 1993).

Therefore in the current study, it was hypothesised that by encouraging the agent, who possesses some interactive ability, to detect and interact with the affordances offered by their performance domain (i.e. the movement studio), the ecological self would be more accurately realised. For example, in the current study, the sport psychology clinician (SPC) aimed to provide information about the persisting and changing planes and surfaces of the movement studio as well as the kinaesthetics of the agent's own bodily intent to facilitate the "actor-environment fit" and thus improve performance ability through enhanced action control strategies.

### **2.2.3 The primacy of the ecological self**

Neisser (1995) proposes that the ecological self is a perceptual and a preconceptual form of self knowledge, preceding the later development of more intellectual and sophisticated aspects of self. Infants have ecological selves long before they develop the cognitive structures on which other aspects of the self will later depend. According to Neisser (1988), the information that specifies the ecological self is omnipresent, and babies are not slow to pick it up. Moreover, these forms of perception never disappear. According to Neisser (1995), the most stringent criteria needed for the awareness of the ecological self in infancy is "awareness of one's situation in an independent spatially extended environment" (p.23). Adults are aware of their immediate ecological and social situations throughout life, even after more representational aspects of the self have become more important. Although the ecological self is in place from early infancy, it nevertheless undergoes development. To some extent, these changes are just necessary accommodations to physical growth, e.g. the notorious clumsiness associated with growth spurts occurring in adolescence. However not all changes in the ecological self result from growth per se; many may reflect the acquisition or improvement of skills (Neisser, 1991, 1995). The process of skill acquisition consists of adaption to constraints imposed by the environment. For example, to become a dancer or an athlete, is to become more aware of one's body and its movements. As Neisser (1991) says: "... to develop a richer, better articulated, and more accurately perceived ecological self" (p.203). Furthermore, although ecological self perception becomes more complete and more precise with development, it is almost never grossly in error. Indeed, the ecological self is not only present but accurate, except in rare pathological cases (Neisser, 1988). More recently, the view of expertise as extreme adaption

to domain-specific constraints has also received more attention in the mainstream cognitive psychology literature (Vincente & Wang, 1998). By virtue of their expert status, sport persons will learn to select out the essential features needed to execute an action that she/he performs relative to a specific physical context. Furthermore, these fine grained attunements become part of a solidly embodied and spontaneously active self-information system (Basson, 1999a; Neisser, 1991; Vincente & Wang, 1998). As self-evidenced by Fraleigh (1993):

*When I dance, I am subtly attuned to my body and my motion in a totally different way than I am ordinarily in my everyday actions. That is, I seldom take notice of my ordinary comings and goings. I'm either in a rush, just getting things done, or maybe couch potatoring, trying to get going. The point is, I'm not really paying much attention to my movement. I'm just doing it (or not, as the case may be). But when I dance, I am acutely aware of my movement, I study it, try out new moves, study and perfect them, until I eventually turn my attention to their subtleties of feeling, and meaning. Finally, I feel free in them. In other words, I embody the motion. When I make any movement truly mine, I embody it. And in this, I experience what I would like to call "pure presence", a radiant power of feeling completely present to myself and connected to the world. This could also be described in other ways, but I think dancing moments can be named. These are the moments when our intentions towards dance are realized (p.104).*

#### **2.2.4 The ecological self: Action and agency**

Neisser's emphases in the definition of the ecological self are important considerations in an imagery intervention which explores the ecological self. The ecological self is a doer: the full expression of the ecological self is realised through purposeful, intentional and agentic action with a simultaneous awareness of being embodied as a "mobile, coherent, effective, space-occupying body" (Neisser, 1995, p.24). The different perceptual systems, for example visual, acoustic and proprioceptive ones, create this awareness of embodiment. However, the full expression of the ecological self is this embodied, agentic self interactively and purposefully engaged with the environment. For the purposes of this study, the self known in *dance* is the ecological self perceived through:

- (a) the kinesthetic of one's own bodily intent;
- (b) the self present in the immediate environment; and
- (c) the self oriented in the present time

"This is the self alive to the moment, the self that sees, feels, and knows its own motion" (Fraleigh, p.104). According to Fraleigh (1987), dance exists on a primordial level, not on an intellectual plane (even though it requires skill and intelligence). "Its inmost substance cannot be reasoned, only experienced. Dance is perceived through the body and on an experiential and kinesthetic level, which precedes words" (p.53).

Once an affordance has been perceived and the appropriate action initiated, that action must be appropriately controlled. According to Neisser (1988), any controllable object that moves together with the body can become part of the ecological self - especially if the movements are self produced. Thus, the experience of a "controllable body" is a principle aspect of the ecological self. In the view of most contemporary action theorists such control and accuracy depends in part on motor programs and schemata. According to Turvey (1994), "the natural physical movement" assumes that motor control is an emergent property of a self-organising system" interacting with the environment" (cited in Moran, 1996, p.30). For example, in a recent study by Savelsbergh and Bootsma (1994 cited in Moran, 1996), it was found that players made finely attuned adjustments to the apertures of their hands when catching balls. These adjustments in hand aperture appeared to parallel the tuning of actions to specific visual information sources such as time-to-contact information. Yet even in such "open-loop" movements, we are aware of what we are doing; the activity of the control schema is often accompanied by a definite - and often powerful kind of - awareness (Neisser, 1988, 1993). As Laura Glenn stated of a particular performance: "I just remember feeling powerful. I had a sense of being at one with the space around me" (cited in Fraleigh, 1993). In Neisser's (1993) view, these rapidly changing, "quasi-conscious motor intentions" are responsible for the sense of agency that is so central to ecological self awareness (p.9). In this context, intention refers to the activation of particular movement control structures. We perceive actions as our own if and only if their consequences match the schemata by which it was generated in the first place. From this, our sense of personal agency is derived (Neisser, 1993). Dancers, athletes, and others skilled in bodily motion are especially sensitive to this fit. According to Neisser (1988), the self is "an embodied actor as well

as an observer, it initiates movements, perceives their consequences, and takes pleasure in its own effectivity" (p.39). Because dance movement is aesthetic in nature, the dancer is aware of her movement: "She initiates it, perceives its consequences, and takes pleasure in her own effectiveness as she moves" (Fraleigh, 1993, p.104). Thus, the dancer is directly attuned to agency as an avenue of self-knowledge:

*When I move in good faith with my intentions, I am fully alive to my powers of motion. I am powerful in dancing moments, because I move with finite, yet gentle, control. The power and the control are the result of the right investiture of energies in accord with intent. At this point, I am released from needing to control; control has been internalised, the movement made easy through years of practice. I no longer need to think about my movement, where it is going, what I am doing. I own my movement (Fraleigh, 1993, p.105).*

### **2.2.5 Affordance theory and the Natural Physical Approach**

The "motor skill natural physical approach" supports J. J. Gibson's affordance theory by postulating that motor skill acquisition and performance are also eco-dependent. According to Turvey (1994), the natural physical movement assumes that motor control is an "emergent property of a self-organising system" interacting with the environment (cited in Moran, 1996, p.30). Turvey (1994) emphasises the direct and inextricable link between action and perception and regards the environment as the storehouse of all information needed to control motor coordination (cited in Moran, 1996). According to Savelsbergh and Bootsma (1994 cited in Moran, 1996):

*... the learning process can be viewed as the establishment of a skill-specific perception-action coupling (p.29).*

The natural physical approach has implications for this study because it forms the link between affordance principles and motor skill development in the execution of a single *pirouette en dehors*. Furthermore, an imagery intervention that emphasises affordances may stimulate the self organising system of the agent and allow for more coordinated performance skill in the execution of an expert motor task requiring fine motor coordination and balance.

## 2.3 Action control

### 2.3.1 Introduction

Any sports person is involved in a complex decision making process when forming an intention to achieve a particular goal. More recently, Beach (1985) has suggested that it is important to distinguish between decision making (i.e. forming an intention) and decision implementation (i.e. actually doing it) (cited in Kendzierski, 1990). A similar distinction has been made in the human social motivation literature (Geen, 1995). Kuhl (1985, 1986) has suggested that it is necessary to distinguish between decision making (i.e. choosing among goals and action alternatives) and action control (i.e. maintaining and enacting intentions). Kuhl has postulated that the presence of sufficient motivation and sufficient ability alone, are not enough to determine whether intentions are enacted (Kendzierski, 1990). A considerable amount of evidence suggests that, in many situations, there may be great discrepancies between intended and performed behaviour (Geen, 1995).

Kuhl (1982, 1983) has proposed a theory of action control which focusses on the processes that presumably intervene between the formation of an intention and its performance (cited in Kuhl & Eisenbeiser, 1986). In his theory of action control, Kuhl suggests that an individual who intends to perform a certain action is subject to various internal and/or external forces which arouse alternative action tendencies. This is because individuals very rarely have just one behavioural inclination in a given situation. To ensure that the intended action will be executed, it must be strengthened and protected against interference until it is performed (Beckmann & Kuhl, 1984; Kuhl, 1985). To account for this function, various action control processes are assumed (i.e. active attentional selectivity, encoding control, emotional control, environmental control, and parsimony of informational processing) (Kendzierski, 1990). For example, individuals who have good action control are likely to reach their goals because they use good voluntary strategies and exercise good control over their emotions and environment.

This study aims to examine the effect of ecological self representational imagery on action control processes. It is predicted that by highlighting the imagined salient features of the environment, the sports person may gain a performance advantage through enhanced action control strategies. It is hoped that an imagery intervention based on ecological self principles will assist the sports person in strengthening and protecting her/his intended action against interference until it is performed.

Thus, action control processes serve as an additional and important determinant of sporting performance in this study. However action control processes need further elaboration in the context of ecological self representational imagery.

### **2.3.2 Two modes of control: Action and state orientations**

The efficiency of the action control process is affected by whether the individual is in an action versus a state orientation. An individual is said to be action oriented when his or her attention is simultaneously or successfully focussed on the following four elements:

- (a) some aspect of the present state
- (b) some aspect of the future state
- (c) a discrepancy between the present and the future state
- (d) at least one action alternative that might remove that discrepancy

If one of those elements is missing, the individual is described as being state oriented (Kendzierski, 1990; Kuhl & Eisenbeiser, 1986).

According to Geen (1995), if the task is difficult and the person feels a sense of control over the outcomes of action, then the person may adopt an action orientation. This is a state of mind characterised by concentration on the various alternatives for action that the person has, before exercising one or more of them. The person who is action oriented avoids attending to or processing information that does not pertain to striving for the goal and instead processes mainly goal-related information. The person also tends to experience emotional and affective states that support and direct meaningful action. For example, difficulties experienced in reaching the goal may inspire feelings of challenge and optimism. Therefore, an action orientation may be aroused by a motivational tendency to control cognitive activities in such a way that maximises the likelihood that some action will be performed (Kuhl & Eisenbeiser, 1986).

According to Kendzierski (1990), an individual is said to be state oriented when "he or she focuses excessively on his or her past, present, or future state, but not on any plan for changing the present situation" (pp.28-29). Thus, instead of adopting an action orientation the individuals attention is



diverted to certain features of the situation or of their own thoughts and feelings. For example, a gymnast who has trouble executing a particular task and, instead of concentrating on what needs to be done, starts thinking about how stressful the situation is or how much disappointment she/he is experiencing. This example characterises a state orientation that is inimical to action and works against it. In general, feelings of a lack of control (e.g. a perceived lack of affordances or a low level of self-efficacy) and helplessness lead to a cessation of goal-directed behaviour (Geen, 1995). Thus, according to Kuhl and Eisenbeiser (1984), a state orientation may be described in terms of a motivational tendency that instigates a cognitive activity for its own sake (i.e. without perceiving it as instrumental for controlling future action). Moreover, Kuhl posits that protecting the current intention often requires a great deal of processing capacity, and that therefore "the efficiency of enacting one's intentions should decrease as a function of the proportion of processing capacity absorbed by state-oriented processes" (Beckmann & Kuhl, 1984, p.227).

The aim of this study, then, is to examine how the activation, construction and representation of the ecological self could enhance the self-regulatory mechanisms which mediate the formation and enactment of intentions. It is proposed that an ecologically relevant imagery intervention could serve to decrease the proportion of processing capacity absorbed by state orientated processes, thereby increasing the efficiency of enacting one's intentions proportionally. This being the case, action control processes will increase through the protection of the current intention. Thus, the sports person could gain a performance advantage through enhanced action control strategies by better approximating the "dynamic animal-environment fit".

### **2.3.3 Empirical evidence**

According to Geen (1995), an individual's orientation following commitment to a goal is, to some extent, determined by environmental stimuli that draw attention toward or away from goal-related actions. Kuhl (1984), postulates several action control processes that may help the individual to shield the current intention against competing tendencies, such as the tendency to engage in state oriented thinking. The first category of mediators relates to the amount of information processed before the final decision is made and the intended action is performed. The second class of mediators comprises processes related to the content of information processed before a decision is made. For example, research suggests that action oriented subjects managed to concentrate on a single category



of information (Kuhl & Beckmann, 1983 cited in Beckmann & Kuhl, 1984) and recognised significantly fewer "irrelevant" environmental cues (Kuhl, 1984). On the other hand, state oriented subjects used the total amount of information available (Kuhl & Beckmann, 1993 cited in Beckmann & Kuhl, 1984) and took notice of both relevant and irrelevant information (Kuhl, 1984).

In the course of everyday behaviour people alternate between action and state orientations (Kuhl, 1984). Nevertheless, there are individual differences in the relative balance between the two states. Some people tend to be action oriented most of the time and others to be state oriented. Thus, the states of action vs state orientation are conceived to be determined by an interaction of situational and personal factors (Geen, 1995). A very powerful situational determinant of state orientation is the prolonged exposure to uncontrollable aversive events (Kuhl, 1981). According to Beckmann and Kuhl (1984), focussing on past failures may be the most frequent instance of state orientation. Additional evidence regarding situational and context-specific determinants of state orientation was found in several experiments. Asking subjects to write a short essay about the causes of failing a task seems to increase state orientation. In contrast, asking subjects to verbalise their hypotheses while solving a problem seems to induce action orientation (Kuhl, 1981).

The application of Kuhl's (1982, 1983) concept of action control to the current study is important to consider since the full expression of the ecological self is only realised through embodied, intentional and agentic *action*. As Fraleigh (1987) says: "...human movement and human body are experienced as synonymous; they are not separable. Movement exists only within the condition of the lived body, in which intentions are fulfilled or unfulfilled. Body is not other than intention and its terminus in action: *it is fulfilled intention in action*" (p.53-54). Therefore, the formation and enactment of intentions will be considered an important aspect of ecological self awareness and effectivity. This study will therefore choose to focus on Kuhl's (1982, 1983) theory of action control to examine the processes that presumably intervene between the formation of an intention and its performance.

### 2.3.4 The empirical measurement of action control

In order to assess the individual differences (dispositional component) in the probability of becoming action or state oriented, Kuhl (1985) has developed a self-report questionnaire (Action Control Scale). The Action Control Scale (ACS) uses three bipolar scales, containing 20 items each, to assess three types of action and state orientations, (Kuhl, 1984):

- (a) *Decision-related action control (AOD)*  
This subscale assesses decision-related action and state orientations (ie: determinate versus vacillating decision making)
- (b) *Performance-related action control (AOP)*  
This subscale assesses performance-related action and state orientations (ie: focussing on the activity versus the goal while performing the action)
- (c) *Failure-related action control (AOF)*  
This subscale assesses failure-related action and state orientations (ie: ruminating about versus ignoring uncontrollable failure)

Individuals identified as having an action orientation are thought to be more likely to maintain and enact their intentions than are individuals identified as having a state orientation. The construct validity and reliability of the Action Control Scale (ACS) are elaborated upon in section 3.7.

## 2.4 Model of conceptual pathways

### 2.4.1 Introduction

The following section describes and graphically presents a model of conceptual pathways for the current study (see Figure 1, p.23). The conceptual model illustrates how an imagery intervention based on ecological self theoretical principles, is postulated to assist the performer in gaining a performance advantage in the execution of a highly skilled motor task (expert performance). Furthermore, the conceptual model illustrates how the above approach will assist the performer in feeling a greater sense of control over the outcomes of her/his action. Thus, the conceptual model is put forward as an attempt to integrate and explain the interrelationships between vividness of movement imagery, action control and performance ability. Finally, a body spatial alignment diagram highlights the implicit system of affordances and/or constraints inherent in any image of a dancer

engaged in the execution of expert movement.

#### 2.4.2 Description of model of conceptual pathways

The model of conceptual pathways (see Figure 1, p. 23) shows the conceptual pathways involved in the perception of environmental affordances by an agent who has some interactive ability. In this study, the expert performer (the dancer) generates an image of the actions (single *pirouette en dehors*) she/he performs in reciprocal relation to the corresponding sports domain (the studio). That image contains the essential features of the environment that afford and constrain the performance of their skilled action (Basson, 1999b; Greeno, 1994; Moran, 1996; Neisser, 1992; Vincente & Wang, 1998). In this study<sup>1</sup>, this could be:

- (a) the hard, resistant surface of the floor from which the dancer needs to "push-off", in order to initiate a single *pirouette en dehors*
- (b) the specific discrimination of visual attention on a centre "spot" in the studio room so that the dancer does not become disorientated during the spinning action of the single *pirouette en dehors*
- (c) the perceptual awareness of the dancer's own body alignment "square" (see figure 2, p.24) in specific relation to the physical dimensions of the studio corners, walls, floor and ceiling
- (d) the kinesthetic awareness of the subtle and exact force generated by the dancer's incoming arm necessary for the momentum of the single *pirouette en dehors*

By virtue of their expert status these dancers will have learnt and selected out these features as opposed to having an actual detailed picture of the context (Basson, 1999b; Marks, 1990; Vincente & Wang, 1998). Furthermore, these fine grained attunements to features of the physical environment serve to activate and affirm an ecological sense of self that is embedded in any image of the dancer engaged in her/his sporting action. Arguing from an ecological perspective, the importance of Neisser's theory in imagery application, would be to systematically explore those aspects of the physical environment significant to the representation of self as dancer, such as:

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<sup>1</sup> For the purpose of this experiment, an imagery script, incorporating ecological self representation, was compiled and administered by the Sport Psychology Clinician (SPC) (Basson, 1999b). Details of the imagery script can be found in Appendix H

- (a) pink ballet pumps, leotard and pink tights, classical hair-style
- (b) ballet studio with *barres* (see section 3.6) situated along the back and side walls, mirrors, "non-slip" sprung floor
- (c) walls and corners of studio in relation to dancer's own body alignment "square" (see Figure 2, p. 24)
- (d) the characteristic "turn-out" of a dancer which is unique to ballet itself and which allows for better postural control, flexibility and aesthetics

By highlighting these imagined salient features as well as elaborating and expanding on them, it is proposed that expert action or skill is better controlled and therefore enhanced. It is further hypothesised that by encouraging the dancer, who possesses some interactive ability, to detect and interact with the affordances offered by her/his physical domain, the "actor-environment fit" will be more accurately realised. This could result in the dancer feeling a greater sense of control over the outcomes of his/her actions. Thus, the dancer may be encouraged to adopt an action orientation as opposed to state orientation in motivation (Geen, 1995), thereby leading to several performance related advantages (adapted from Basson, 1999b).

The following passage (see p.22) is an extract taken from a ballet manual on the essential qualities required for the proper execution of a *pirouette*. The classical ballet manual is based entirely on those theoretical and practical principles advocated and taught by Maestro Cav. Enrico Cecchetti whose famous exercises have produced many dancers of international repute. This extract highlights some of the subtle features (affordances and constraints) which a dancer would need to consider when rehearsing a single *pirouette en dehors*. These essential features could therefore be incorporated into an imagery intervention which aims to elicit ecological self awareness in dance.

### *Observations on Pirouettes*

*Pirouettes require considerable exercise and study. The essential qualities for their execution demand that the pupil should be slender, his limbs soft and pliable, and his legs formed naturally close together. You have seen that the body is supported entirely on the **demi-pointe** of one foot. Consider how slight is the base upon which the whole body turns. For this reason you must press strongly against the ground all the toes of the supporting foot, so that by their expansion you will increase the size of the base and thereby materially assist the equilibrium of the body. Unless these precautions are taken your body will sway and rock on the naturally convex surface of the sole, the equilibrium will be lost, and the **pirouette** rendered impossible of execution. During the execution of the **pirouette** - (1) Take care that the supporting foot does not rise beyond **sur la demi-pointe**; that is, **sur les trois quarts de la pointe**. (2) Do not jump on the supporting foot. (3) Take care that the head does not remain rigidly upright, but is the last to move as the body turns away from the spectator, and the first to move as the body returns towards the spectator. Finally, great care should be exercised in the force of momentum generated by the sweep across of the extended arm. Insufficient strength will cause the body to stop before the completion of the turn, conversely, too much strength will cause the body to pass beyond the point desired. The position of the arms in a **pirouette** is between the **fifth position en bas** and the **fifth position en avant**, although it is usually described as the **fifth position en bas** (Beaumont, Idzikowski & Cechetti, 1977, p.199).*



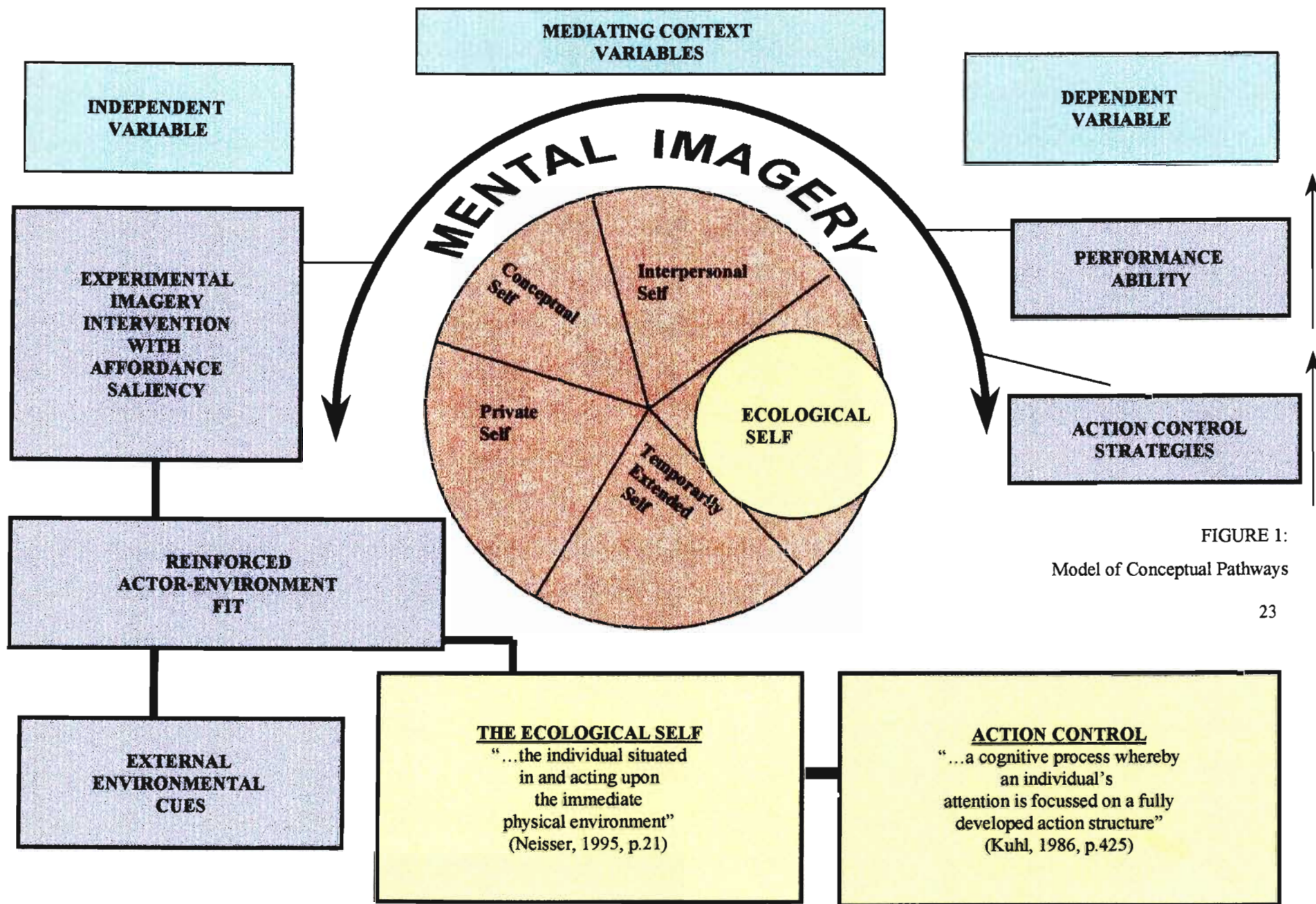


FIGURE 1:  
Model of Conceptual Pathways

### 2.4.3 The experimental task of the study

The experimental task of choice in this study was the execution of the single *pirouette en dehors*. A single *pirouette en dehors* may be defined as one turn on the three-quarter (as in this study) or full-pointe towards the working leg of the back foot and away from the supporting leg of the front foot. The working leg is held in the *retire* position.

**Figure 2**

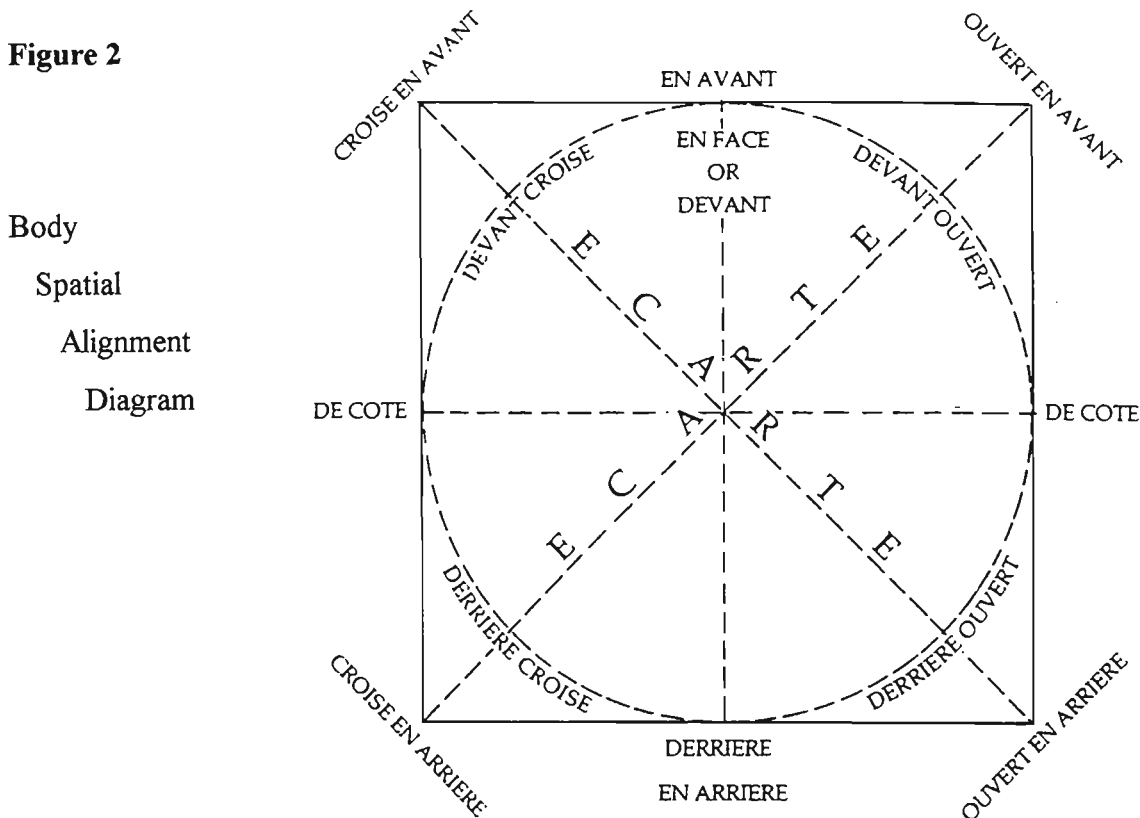


Figure 2 above gives the alignment of the dancer's body within the framework of her own square (see Appendix A for glossary of French terms). Consider the right as the working foot. From a very early age, all ballet dancers are required to have a sound understanding of the French terms used and the spatial dimensions which they represent. The dancer becomes highly skilled in interacting this knowledge in a specialised way with the invariants and variants of the physical space through which she/he moves. This knowledge then becomes part of an implicit and automatically activated self-information system that is embedded in any image of a dancer engaged in their dancing action. Therefore, it may be said that this type of knowledge is a specialised and unique form of knowledge which is fundamental for the survival of any dancer engaged in her/his dancing action.



## 2.5 Summary

This chapter has explored the relevant literature on the concept of mental imagery as defined in this study. Defining mental imagery was identified as one of the more contentious issues in sport psychology. The differing etiological positions located in the literature were briefly explored, highlighting the lack of clarity and ongoing complexity surrounding this area of research. The role of imagery in the development, maintenance and integration of an ecological representation of self (Suler, 1996; Neisser, 1995) was put forward as one of the context variables which may account for the efficacy of mental imagery in sport (Basson, 1997). Furthermore, this chapter explored the literature on Neisser's concept of the ecological self which draws heavily on J. J. Gibson's theory of affordance (cited in Greeno, 1994). The related concepts of affordance, constraint and ability were defined and explained as the central relations underlying the interaction of perceiver and environment. For purposes of the current study, the application of the above concepts were discussed as they apply to the self known in *dance*. Finally, the "natural physical" movement was put forward as having potential relevance to this field of research (cited in Moran, 1996).

This chapter also introduced Kuhl's (1982, 1983) theory of action control as an important mediating variable to consider in the imagery-performance relationship. The two modes of control (action and state orientation) were defined and explained as they relate to the current study. Furthermore, empirical evidence was put forward in support of the theory of action control. Finally, the empirical measurement used to assess the utilization of action control strategies was examined.

A conceptual model was put forward in an attempt to integrate and explain the interrelationships between vividness of movement imagery, action control and performance ability. Finally, the body spatial alignment diagram highlighted the implicit system of affordances and/or constraints inherent in any image of a dancer engaged in the execution of expert movement.

## CHAPTER THREE

### METHODOLOGY

#### 3.1 Principle and secondary research hypotheses

It was hypothesised that significant differences would exist between the three groups in favour of the experimental imagery group, relative to the imagery control and standard control groups, from pre- to post-intervention conditions. The relationships between the vividness of movement imagery, action-control and performance ability were explored. Specifically, the following outcomes were anticipated.

The current study's principle research hypothesis is reflected in Table 1 below.

**Table 1**

<b>PRINCIPLE RESEARCH HYPOTHESIS</b>	
<b>PRINCIPLE NULL HYPOTHESIS (<math>H_0</math>)</b>	<b>PRINCIPLE ALTERNATIVE HYPOTHESIS (<math>H_1</math>)</b>
1 There will be no significant differences in mean difference measures of performance ability (PSEC) between the three groups in favour of the experimental imagery group in relation to the other two control groups at the 0.05 level of probability (1-tailed)	1 There will be significant differences in mean difference measures of performance ability (PSEC) between the three groups in favour of the experimental imagery group in relation to the other two control groups at the 0.05 level of probability (1-tailed)

The current study's secondary research hypotheses are reflected in Table 2 below.

**Table 2**

<b>SECONDARY RESEARCH HYPOTHESES</b>	
<b>SECONDARY NULL HYPOTHESES (<math>H_0</math>)</b>	<b>SECONDARY ALTERNATIVE HYPOTHESES (<math>H_1</math>)</b>
2 There will be no significant differences in mean difference measures of vividness of movement imagery (VMIQ) between the three groups in favour of the experimental imagery group in relation to the other two control groups at the 0.05 level of probability (1-tailed)	2 There will be significant differences in mean difference measures of vividness of movement imagery (VMIQ) between the three groups in favour of the experimental imagery group in relation to the other two control groups at the 0.05 level of probability (1-tailed)
3 There will be no significant differences in mean difference measures of action control (ACS) between the three groups in favour of the experimental imagery group in relation to the other two control groups at the 0.05 level of probability (1-tailed)	3 There will be significant differences in mean difference measures of action control (ACS) between the three groups in favour of the experimental imagery group in relation to the other two control groups at the 0.05 level of probability (1-tailed)

It is further speculated that pre-and post-intervention measures of vividness of movement imagery (VMIQ), action control (ACS) and performance ability (PSEC) will be significantly correlated at the 0.05 level of probability (2-tailed).

### **3.2 Research design**

The study utilized a primarily quantitative, true experimental design. The method of random assignment was used to obtain three equivalent groups ( $n = 12$ ): the standard control group, the imagery control group and the experimental imagery group. Variances between the three groups in performance ability, vividness of movement imagery and action control were examined using parametric and nonparametric statistical procedures. Furthermore, the nature and direction of the relationships between pre- and post-intervention measures of vividness of movement imagery, action control and performance ability were explored using bivariate correlational and multiple regression tests. Therefore, analytic procedures were univariate, bivariate and multivariate in nature. It was hence, both a causal and correlational study which aimed to attribute causality to the independent variable as well as to explore the relationships between independent, mediating and dependent variables.

### 3.3 Characteristics of the sample

A sample of 36 female ballet dancers (aged between 11 - 13) were secured from five reputable ballet schools. The method of random assignment was used to obtain three equivalent and comparable groups ( $n = 12$ ). This was to ensure that the subject characteristics were evenly distributed between the three groups. In order to better differentiate and compare the independent effects of the three group interventions on vividness of movement imagery, action control and performance ability, the two imagery groups were not given standard, technical instructions on the execution of the single *pirouette en dehors*. As reflected in Table 3 below, the independent variable of instruction intervention was manipulated whereupon each group received a different mode of instruction intervention.

**Table 3**

INDEPENDENT VARIABLE OF INSTRUCTION INTERVENTION	
GROUP	INSTRUCTION INTERVENTION
The standard control group	Relaxation exercise and standard, technical instruction with no explicit reference made to imagery and/or ecological self representation
The imagery control group	Conventional cognitive-motor relaxation and mental imagery exercise with no explicit reference made to ecological self representation. No standard, technical instructions were given to this group
The experimental imagery group	Affordance salient cognitive-motor relaxation and mental imagery exercise with specific reference to ecological self representation. No standard, technical instructions were given to this group

The mediating variables in the study were vividness of movement imagery and action control while the dependent variable was performance ability. All three groups were treated equivalently and were tested in the same location, at the same time of day. Therefore, any variations in the mediating and dependent variables were attributed to the manipulation of the independent variable. The variables of gender, developmental stage, past and current levels of skill and previous mastery experiences were controlled for, with the variables of youth and adolescence as potential extraneous variables.

Initially, the experimental design included both a pre- and post-intervention assessment procedure (approximately six weeks later). The aim here was two-fold. Firstly, the investigator aimed to provide the subjects with adequate time to learn, practice and rehearse the skill of mental imagery (Suinn, 1993) so that the expected benefits in performance ability would be properly realised. Secondly, the investigator aimed to determine the direction and extent of change in vividness of movement imagery, action control and performance ability across the three groups over time. However, severe subject attrition as well as time and budget constraints restricted the proposed implementation of the experimental design to a pre-intervention assessment phase only. At the end of the experimental procedure, ethical considerations necessitated the administration of the experimental imagery intervention to the two control groups. In this way, any performance benefits were assumed to be more evenly distributed across the three groups.

### **3.4 Sampling procedure**

The head of five reputable ballet schools in the Pietermaritzburg and Hilton areas were approached telephonically to request permission to conduct research at their respective ballet schools. A positive response was received from all five ballet schools. Appointments were made to attend the respective weekly ballet classes, in order to secure subjects. Prior to the ballet classes a brief introduction to the researcher and the study was made. After the ballet classes the researcher personally approached individual ballet dancers, explained the purpose of the study and distributed questionnaire packages to interested ballet dancers. Arrangements were made for the collection of the questionnaires, with most questionnaires being collected at subsequent ballet classes. Telephonic reminders were made as necessary. The response rate of the current study was 85% with a sample of 36 volunteers being secured from the five registers pertaining to each school. Letters of informed consent with attached indemnity forms were posted to the teachers and parents concerned for signed approval.

### **3.5 Subjects**

Subjects ( $N = 36$ ) were female ranging in age from 11 to 13 years at a Grade 5 level of technical ability. In order that the sample was as homogeneous as possible with regard to skill level, the following criteria were adopted in the selection of subjects: Ballet dancers were selected on the basis that they had attained an internationally accepted (Royal Academy of Dancing (RAD): Grade 5) level of technical skill and performance ability. Furthermore, subjects were selected on the basis that they

had no prior instruction in the execution of a double pirouette. Therefore, dancers of a RAD Grade 5 level have only been instructed in the execution of a single *pirouette en dehors*. Furthermore, due to fluctuations in the rate of growth during adolescence (Beunen & Malina, 1996), subjects were selected on the basis that they had not developed secondary sexual characteristics. Therefore, it may be argued that all subjects were of comparable skill, ability and developmental stage. Subjects were randomly assigned to one of three interventions, consisting of 12 subjects in each group, to eliminate any baseline differences. All subjects were treated according to the ethical guidelines prescribed by the APA (American Psychological Association, 1994).

### 3.6 Apparatus

Any special equipment used to conduct the current study is described in Table 4 below:

**Table 4**

<b>APPARATUS</b>	
<b>Barre</b>	A barre was used as a support apparatus to assist the participants during the warm-up phase of the experimental procedure (see section 3.8.2)
<b>Tape recorder</b>	A tape recorder was used to record the responses of the participants as an informal evaluation of the imagery intervention and <i>pirouette</i> performance (see section 3.8.2)
<b>Video Camera</b>	The experimental procedure was video recorded for future reference, evaluation and assessment by interested researchers, teachers and examiners

### 3.7 Psychometric instruments

All subjects completed the psychometric instruments listed below to enable the author to assess the various research variables. The following four psychological instruments were used to collect the biographical information and quantitative data for the current study and are included in Appendices B, C, D and E:

- (a) The Biographical Information Questionnaire
- (b) The Vividness of Movement Imagery Questionnaire (Isaac, Marks & Russel, 1986)
- (c) The Action Control Scale (Kuhl, 1985)
- (d) The Performance Skill Evaluation Chart (Fuller, personal collaboration, 1999)



### **3.7.1 The Biographical Information Questionnaire (BIQ)**

The BIQ was constructed in joint collaboration with the research supervisor of the current study, a sport psychology clinician (see Appendix B). The BIQ comprised items pertaining to the subject's name (used for follow-up purposes only), age, number of years engaged in the study of classical ballet including current duration and frequency of practice as well as previous levels of mastery. Furthermore, due to the age (11 - 13 years) and developmental stage (adolescence) of the subjects, additional items pertaining to secondary sexual characteristics were incorporated to control for potential confounding variables. Due to the highly personal nature of this particular subsection, the strictly confidential and discrete utilization of such information was emphasised.

### **3.7.2 The Vividness of Movement Imagery Questionnaire (VMIQ)**

The VMIQ (Isaac, Marks & Russel, 1986) was administered for the purpose of identifying individual differences in the visual imagery of movement and imagery of kinaesthetic sensation with movement (see Appendix C). The VMIQ is composed of 24 items relevant to movement imagery. Subjects are required to image each item both with respect to someone else (external vividness of movement imagery) and themselves (internal vividness of movement imagery). The 5-point scale developed by Marks (1973) is used to assess image vividness (in Isaac et al, 1986). The 5-point scale contains the two extreme values, midpoint and only one extra scale value on either side of the midpoint.

The VMIQ is capable of providing reliable data regarding the visual imagery of movement. The test-retest reliability coefficient of 0.76 obtained from a main group of 220 students is acceptably high. The longer term stability of the VMIQ was assessed using analysis of variance procedures with smaller experimental groups. The analysis revealed no reliable differences in mean total scores between multiple administration of the questionnaire:  $F=2.14$ ;  $p>0.05$ . This result is encouraging since these administrations were repeated over a six month period. The validity of the VMIQ was demonstrated in a preliminary manner with respect to the VMIQ. With the largest group, a correlation coefficient of 0.81 was obtained. The lower but also significant coefficients for each of the smaller groups using the Spearman Rank Correlation Coefficient were 0.75, 0.45 and 0.65. Thus, the VMIQ is regarded as a reliable, stable and valid measure of an individual's ability to produce images of movement (Isaac et al, 1986).

### *Reliability analysis of the VMIQ for the current study*

Inter-item correlation matrices revealed that all items were strongly and positively correlated with each other for both pre- and post-intervention measures of external and internal VMIQ indicating high internal consistency among the individual items for composite VMIQ. Furthermore, the reliability coefficients were high, confirming the strong internal consistency of the instrument (pre-intervention VMIQ:  $\alpha = 0.96$ ; post-intervention VMIQ:  $\alpha = 0.97$ ).

Further reliability analyses were performed for both pre-and post-intervention measures of internal VMIQ (pre-intervention internal VMIQ:  $\alpha = 0.92$ ; post-intervention internal VMIQ:  $\alpha = 0.96$ ) and external VMIQ (pre-intervention external VMIQ:  $\alpha = 0.93$ ; post-intervention external VMIQ:  $\alpha = 0.95$ ) clearly showing high positive internal consistency for both measures.

### **3.7.3 The Action Control Scale (ACS)**

The theory of action control specifies assumptions regarding personal and situational determinants of action control (Kuhl, 1985). In this study the personal determinant of action control was assessed by means of a self-report scale (The Action Control Scale) developed by Kuhl (1985) (see Appendix D). The Action Control Scale consists of three bipolar subscales:

- (a) Performance-related action versus state orientation, i.e. focussing on the activity versus the goal while performing an action (AOP)
- (b) Failure-related action versus state orientation, i.e. ruminating about versus ignoring uncontrollable failure (AOF)
- (c) Decision-related action versus state orientation, i.e. determinate versus vacillating decision making (AOD)

Each original subscale contained 20 items. However, due to the relatively young age of the participants in this study (11-13 years), it was decided to randomly reduce each subscale to 12 items with a reliability of 69% using the Spearman Brown formula (Faulds, personal communication, 1999). Therefore, for the purposes of this study, each revised subscale contains six items assessing *behavioural* manifestations of action and state orientations and six items assessing *cognitive* manifestations. Each item specifies a situation and two response alternatives, one indicating an action

oriented and the other one indicating a state oriented response. According to Kuhl (1985), it has proven useful to combine the cognitive and the behavioural items for most experimental purposes. The three scores for AOP, AOF and AOD are computed by summing all action oriented answer alternatives endorsed by the subject, separately for each scale. In a recent study by Kuhl (1985), using a sample of 115 subjects, the following estimates of internal consistency (Cronbach's alpha) have been obtained: 0.74 (AOP); 0.79 (AOF) and 0.79 (AOD) (Kuhl, 1985)

Correlations between AO-scores and several personality variables indicated a theoretically expected overlap with test anxiety, extraversion, self-consciousness, achievement motivation, future orientation, and cognitive complexity (Kuhl, 1984). The moderate size of these correlations ( $<0.36$ ), however, indicates that a substantial proportion of variance in action orientation scores cannot be accounted for by any of the personality variables mentioned above (Kuhl, 1985).

#### *Reliability analysis of the ACS for the current study*

Initial reliability analyses performed on pre- and post-intervention action control showed relatively poor internal consistency for the whole scale (pre-intervention:  $\alpha = 0.60$  and post-intervention:  $\alpha = 0.63$ ). Furthermore, reliability analyses on the pre- and post-intervention subscale measures of composite action control revealed that the AOP (performance-related action vs state orientation) subscale had an extremely poor internal consistency (pre-intervention:  $\alpha = 0.34$  and post-intervention:  $\alpha = 0.53$ ). The pre-intervention AOF (failure-related action vs state orientation) subscale also showed low internal consistency ( $\alpha = 0.68$ ) while the post-intervention AOF subscale showed reasonably satisfactory internal consistency ( $\alpha = 0.76$ ). Furthermore, both the pre- and post-intervention AOD (decision-related action vs state orientation) subscales showed poor internal consistencies for the individual items (pre-intervention:  $\alpha = 0.50$  and post-intervention:  $\alpha = 0.52$ ).

On further examination, it was found that 50% of the items contained within both the pre- and post-intervention AOP subscales were highly negatively correlated with composite ACS scores. Based on these results, it was decided to delete the AOP subscale from pre- and post-intervention composite ACS in order to raise the alpha level to a more acceptable level. Accordingly, the internal consistency of pre- and post-intervention ACS improved to a reasonably satisfactory level

(pre-intervention:  $\alpha = 0.70$  and post-intervention:  $\alpha = 0.76$ ).

### 3.7.4 The Performance Skill Evaluation Chart (PSEC)

The PSEC is a measure of technical performance skill and ability (see Appendix E). The PSEC was constructed in joint collaboration with an internationally qualified Royal Academy of Dancing (RAD) teacher and examiner (Fuller, personal collaboration, 1999). The PSEC contains the necessary criteria required by the Grade 5 (RAD) syllabus to correctly execute a single *pirouette en dehors* (Beumont & Idikowski, 1966; Royal Academy of Dancing, 1967; Robbins, 1981). Subjects were individually rated on a six point scale (ranging from 6 = *very superior* to 1 = *very poor*) according to relevant criteria contained within the four components of the *pirouette en dehors*:

- (a) Preparation
- (b) *Pirouette* position during turn
- (c) Quality of turn
- (d) Finishing position

Each subject's performance ability was rated on both the right and left sides of the *pirouette en dehors*. An overall score for performance ability was obtained using ratings from both sides. Subjects were individually evaluated on the basis of technical merit only by a panel of four independent and neutral RAD classical ballet examiners so as to eliminate experimenter bias.

*Inter-rater reliability analyses between the four raters evaluating the subjects on their pre- and post-intervention performance ability scores for the current study*

**Table 5**

<b>INTER-RATER RELIABILITY ANALYSES BETWEEN THE FOUR RATERS</b>								
<b>Pre- intervention</b>	<b>Rater 1</b>		<b>Rater 2</b>		<b>Rater 3</b>		<b>Rater 4</b>	
<b>Rater 1</b>	...		$r = 0.70$	$p < 0.000$	$r = 0.73$	$p < 0.000$	$r = 0.92$	$p < 0.000$
<b>Rater 2</b>	$r = 0.70$	$p < 0.000$	...		$r = 0.76$	$p < 0.000$	$r = 0.75$	$p < 0.000$
<b>Rater 3</b>	$r = 0.73$	$p < 0.000$	$r = 0.76$	$p < 0.000$	...		$r = 0.73$	$p < 0.000$
<b>Rater 4</b>	$r = 0.92$	$p < 0.000$	$r = 0.75$	$p < 0.000$	$r = 0.73$	$p < 0.000$	...	
<b>Post- intervention</b>	<b>Rater 1</b>		<b>Rater 2</b>		<b>Rater 3</b>		<b>Rater 4</b>	
<b>Rater 1</b>	...		$r = 0.76$	$p < 0.000$	$r = 0.71$	$p < 0.000$	$r = 0.88$	$p < 0.000$
<b>Rater 2</b>			...		$r = 0.84$	$p < 0.000$	$r = 0.87$	$p < 0.000$
<b>Rater 3</b>	$r = 0.71$	$p < 0.000$	$r = 0.84$	$p < 0.000$	...		$r = 0.82$	$p < 0.000$
<b>Rater 4</b>	$r = 0.88$	$p < 0.000$	$r = 0.87$	$p < 0.000$	$r = 0.82$	$p < 0.000$	...	

Pearson's product-moment correlation technique was used to determine the degree of pre- and post-intervention reliability between the four raters. As reflected in Table 5 above, highly significant and positive associations were observed between all four raters for both pre- and post-intervention measures indicating strong inter-rater reliability. Overall, post-intervention inter-rater reliability was higher than pre-intervention inter-rater reliability for performance ability.

### 3.8 Experimental procedure

The procedure used to carry out the study and collect the research data is reflected in Table 6 below.

**Table 6**

<b>EXPERIMENTAL PROCEDURE</b>			
<b><u>PHASE I</u></b> <b>Prior to the experiment</b> <b>PRE-INTERVENTION</b>	1	Biographical Information questionnaire	
	2	Vividness of Movement Imagery Questionnaire	
	3	Action Control Scale	
<b>ASSESSMENT</b>			
<b>ACTIVITY</b>	1	Group relaxation and mental preparation exercise	
<b><u>PHASE II</u></b> <b>The Experiment</b> <b>PRE-INTERVENTION</b>	1	Warm up	
	2	Execution of single pirouette	
	3	Performance Skill Evaluation Chart	
<b>ACTIVITIES</b>			
<b>INTERVENTION</b>	<b>GROUP 1</b>	<b>GROUP 2</b>	<b>GROUP 3</b>
	<b>Standard Control</b>	<b>Imagery Control</b>	<b>Experimental Imagery</b>
<b><u>PHASE II</u></b> <b>The Experiment</b> <b>POST-INTERVENTION</b>	1	Warm up	
	2	Execution of single pirouette	
	3	Performance Skill Evaluation Chart	
<b>ACTIVITIES</b>			
<b>ASSESSMENT</b>	1	Vividness of Movement Imagery Questionnaire	
	2	Action Control Scale	
	3	Informal evaluation of imagery and performance ability	



### 3.8.1 Phase I: Prior to the experiment

#### *Pre-intervention assessment*

As can be seen from Table 6 above, the Biographical Information Questionnaire (BIQ), Vividness of Movement Imagery Questionnaire (VMIQ) and Action Control Scale (ACS) were administered individually to the participants prior to the experiment taking place in a controlled setting. The confidential and voluntary nature of the study procedure was emphasised and written informed consent obtained from each subject, the parents or guardian of each subject and the ballet teacher of each subject. The 36 subjects were randomly assigned to one of three groups ( $n = 12$ ): Group 1 (standard control), Group 2 (imagery control) and Group 3 (experimental imagery).

#### *Pre-intervention activity*

The SPC administered the following brief (10 minutes) relaxation and mental training exercises to each group prior to the experiment taking place: Group 1 (standard control) received a group relaxation exercise and standard, technical instructions which were specifically devoid of any explicit reference to imagery and/or ecological self representation. Group 2 (imagery control) received a group relaxation and conventional imagery training exercise which was specifically devoid of explicit reference to ecological self representation. Group 3 (experimental imagery) received a group cognitive-motor relaxation and mental imagery training exercise which made explicit reference to ecological self principles. It should be noted that no standard, technical instructions were given to the two imagery groups.

### 3.8.2 Phase II: The experiment

#### *Pre-intervention activities*

The three groups were instructed in a 15 minute classical ballet warm-up at the *barre* (see section 3.6, Table 4) by a RAD classical ballet teacher. The purpose of the warm-up was to prepare the body for the physical demands of the experimental task (i.e. single *pirouette en dehors*) and to reduce the risk of injury. This was achieved by increasing the core temperature of the body and the functional capacity of the large muscle groups.

To ensure that the performance ability of each subject was fairly and thoroughly evaluated, each participant was requested to individually perform a single *pirouette en dehors* on the right and left side. The performance ability of each participant was independently evaluated by a panel of four neutral and independent RAD classical ballet examiners using the Performance Skill Evaluation Chart (PSEC).

### *Intervention phase*

As reflected in Table 6 above, the independent variable of mode of instruction intervention was manipulated between the three groups for 45 minutes in a controlled setting. An RAD classical ballet teacher administered a relaxation exercise and standard technical lecture on the execution of a single *pirouette en dehors* to the standard control group (see Appendix F). The SPC administered a conventional cognitive-motor relaxation and imagery intervention to the imagery control group (see Appendix G) and a cognitive-motor relaxation and ecologically relevant imagery intervention to the experimental imagery group (see Appendix H).

### *Post-intervention activities*

The phase II pre-intervention activity phase was repeated exactly.

### *Post-intervention assessment*

As can be seen from Table 1 above, the Vividness of Movement Imagery Questionnaire (VMIQ) and The Action Control Scale (ACS) were readministered to the participants to assess pre- to post-intervention variations. Thereafter, a SPC individually interviewed the participants as an informal evaluation of their subjective experience of the imagery intervention and *pirouette en dehors* performance (see section 3.6, Table 4).

## **3.9 Statistical treatment**

Data analysis was conducted using the Statistical Package for the Social Sciences (SPSS/PC 8.0). Descriptive statistics were generated for the variables of age and number of years of study as well for each instrument. Reliability analyses (alpha) and inter-item correlation tests were performed for The Vividness of Movement Imagery Questionnaire (VMIQ) and The Action Control Scale (ACS) to assess the internal consistencies of the individual items within each of the subscales and

subcomponent measures as well as to assess the overall validity of each instrument.

The possible relationships between pre- and post-intervention vividness of movement imagery, action control and performance ability were explored using Pearson's product-moment correlation and multiple regression procedures. The bivariate correlational tests and multiple regression tests were performed to determine the magnitude and direction of the relationships between the abovementioned variables. A series of parametric one-way ANOVA tests, a MANOVA test as well as nonparametric Kruskal-Wallis tests were performed to identify variations across the three alternative modes of instruction intervention for pre- and post-intervention, vividness of movement imagery, action control and performance ability. Various post-hoc tests were conducted to obtain statistical confirmation of the study's principle research hypothesis.

### **3.10 Summary**

The primary purpose of this study was to explore the effect of ecological self imagery on performance ability. Secondly, the study aimed to explore the magnitude and direction of the relationship between vividness of movement imagery, action control and performance ability. Data was collected from a random sample of 36 young ballet dancers, aged between 11 - 13 years. Subjects were randomly assigned to three comparable and equivalent groups of subjects ( $n = 12$ ): Group 1 (standard control), Group 2 (imagery control) and Group 3 (experimental imagery). In this regard, the study aimed to investigate what differences would be found between the three groups. The significance of the study's principle and secondary research hypotheses was explored through the use of various statistical procedures which were computed using the SPSS/PC 8.0 statistical package.

## CHAPTER FOUR

### RESULTS

#### 4.1 Introduction

Characteristics of the sample will be presented, followed by analyses of data conducted in service of the hypotheses. The main results of the study will be presented in sufficient detail to justify the conclusions. All relevant results will be presented including those that run counter to the principle and secondary hypotheses. The results were obtained with the use of the SPSS/PC 8.0 statistical package. Significant relationships, as they are related to the hypotheses are presented, with the maximum level of significance set at 5% ( $\alpha = 0.05$ ). In some cases, certain non-significant findings are also included as they relate to the hypotheses<sup>2</sup>. A key of abbreviations is presented in Appendix I and gives a description of the abbreviations that will be used throughout this section.

#### 4.2 Section one: Results of primary importance to the study

Section one presents the main results of the study generated from a series of one-way ANOVA procedures and nonparametric Kruskal-Wallis tests which were performed to identify pre- and post-intervention variations across the three groups (standard control, imagery control and experimental imagery) for each instrument:

- (a) The Biographical Information Questionnaire (BIQ)
- (b) The Performance Skill Evaluation Chart (PSEC)
- (c) The Vividness of Movement Imagery Questionnaire (VMIQ)
- (d) The Action-Control Scale (ACS)

The descriptive statistics, generated for the variable of age as well as for each instrument, were integrated into the main results of the study in order to assess levels of pre- and post-intervention performance ability (PSEC), vividness of movement imagery (VMIQ) and action control (ACS) for the entire sample ( $N = 36$ ) and for each group ( $n = 12$ ).

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<sup>2</sup> All raw data and result print-outs can be obtained from the author on request and were not included due to length.

#### 4.2.1 Results from the Biographical Information Questionnaire (BIQ)

Table 7

<b>KEY TO TABLE 7:</b> GROUP 1 : STANDARD CONTROL GROUP GROUP 2 : IMAGERY CONTROL GROUP GROUP 3 : EXPERIMENTAL IMAGERY GROUP				
<b>SUMMARY OF DESCRIPTIVE STATISTICS FOR THE BIOGRAPHICAL INFORMATION QUESTIONNAIRE (BIQ) FOR THE SAMPLE (N = 36) AND FOR EACH GROUP (n = 12)</b>				
VARIABLE		N	MEAN	STANDARD DEVIATION
<b>AGE OF SUBJECTS:</b> <b>Years</b>	1	12	11.67	0.89
	2	12	12.08	0.90
	3	12	12.00	0.95
	Total	36	11.92	0.91
<b>THE STUDY OF BALLET:</b> <b>Number of years</b>	1	12	8.33	0.98
	2	12	8.21	1.08
	3	12	8.50	1.31
	Total	36	8.35	1.11
<b>BALLET CLASS ATTENDANCE:</b> <b>Number of days per week</b>	1	12	2.17	0.39
	2	12	2.25	0.45
	3	12	2.25	0.45
	Total	36	2.22	0.42
<b>AVERAGE DURATION PER CLASS:</b> <b>Minutes</b>	1	12	54.58	5.82
	2	12	53.75	11.89
	3	12	54.58	6.89
	Total	36	54.31	8.38

##### *Demographic characteristics of respondents*

All participants in the experiment were female and of the Grade 5 level of skill and ability (Royal Academy of Dancing). Participants were secured on the basis that they had not been instructed in the execution of a double *pirouette en dehors* and had not developed secondary sexual characteristics.

As reflected in Table 7 above, results of the BIQ revealed that the three groups were comparable across the variables of age, number of years engaged in the study of classical ballet, frequency of ballet class attendance and average duration per ballet class.

The spread in age for the entire sample was:  $M = 11.92$ ,  $SD = 0.91$ , range 11 - 13. Descriptive statistics generated for the variable of age across the three groups revealed that the imagery control group had the highest non-significant mean age ( $M = 12.08$ ,  $SD = 0.90$ ); followed by the experimental imagery group ( $M = 12.00$ ,  $SD = 0.95$ ) and finally the standard control group ( $M = 11.67$ ,  $SD = 0.89$ ).

The number of years engaged in the study of classical ballet for the entire sample ranged from 6 - 10 years ( $M = 8.35$ ,  $SD = 1.11$ ). The following descriptive statistics were generated for this variable across the three groups: the experimental imagery group ( $M = 8.50$ ,  $SD = 1.31$ ); the standard control group ( $M = 8.33$ ,  $SD = 0.98$ ) and the imagery control group ( $M = 8.21$ ,  $SD = 1.08$ ).

Furthermore, the average frequency of classical ballet class attendance for the entire sample was twice per week ( $M = 2.22$ ,  $SD = 0.42$ ). Descriptive statistics generated for the variable of frequency of attendance across the three groups revealed a shared mean frequency of attendance for the imagery control and experimental imagery groups ( $M = 2.25$ ,  $SD = 0.45$ ) while the standard control group revealed a marginally lower non-significant mean frequency of attendance ( $M = 2.17$ ,  $SD = 0.39$ ).

Finally, the average duration per classical ballet class for the sample ( $N = 36$ ) was approximately 30 - 60 minutes per day ( $M = 54.31$ ,  $SD = 8.38$ ). Descriptive statistics generated for the variable of duration across the three groups revealed a similar mean duration for the standard control ( $M = 54.58$ ,  $SD = 5.82$ ) and experimental imagery groups ( $M = 54.58$ ,  $SD = 6.89$ ) while the imagery control group revealed a slightly lower mean duration ( $M = 53.75$ ,  $SD = 11.89$ ). Furthermore, it was noted that the imagery control group revealed a wider dispersal of scores relative to the other two groups.



ANOVA and Kruskal-Wallis testing revealed no significant differences between the three groups for any of the abovementioned biographical variables, at the 0.05 level of probability. Furthermore, Levene tests for Equality of Variance for the abovementioned biographical variables were found to be non-significant, indicating homogeneity of variance across the three groups, at the 0.05 level of probability.

After “eye-balling” the outstanding biographical data, it would be reasonable to assume that average intensity of previous and current levels of activity was moderate to high; the degree of impact of such activity ranged from low- to high-impact and the majority of subjects (94.45%, 34/36) were primarily right-leg dominant.

#### 4.2.2 Results from the Performance Skill Evaluation Chart (PSEC)

*Pre- and post-intervention scores for the Performance Skill Evaluation Chart for the entire sample (N = 36) and for each group (n = 12)*

**Table 8**

SUMMARY OF DESCRIPTIVE STATISTICS FOR THE PERFORMANCE SKILL EVALUATION CHART (PSEC) FOR THE ENTIRE SAMPLE (N = 36) AND FOR EACH GROUP (n = 12)									
	PRE-INTERVENTION			POST-INTERVENTION			MEAN DIFFERENCE		
	COMPOSITE PERFORMANCE ABILITY								
VARIABLE	n	Mean	SD	n	Mean	SD	n	Mean (d)	SD (d)
1 Standard control	12	48.05	13.63	12	52.78	14.59	12	4.73**	4.12
2 Imagery control	12	51.96	7.75	12	51.20	8.90	12	-0.76	6.07
3 Experimental imagery	12	46.88	18.39	12	43.77	19.96	12	-3.10	4.35
Entire sample	36	48.96	13.73	36	49.25	15.26	36	0.29	5.83

As reflected in Table 8 above, mean difference results for the entire sample revealed an overall improvement in composite PSEC from pre- to post-intervention conditions. It was further noted that standard deviations for mean difference scores of performance ability were relatively large, indicating considerable variations in performance ability across the three groups.

ANOVA and Kruskal-Wallis testing<sup>3</sup> between the three groups revealed no significant pre-intervention differences between the standard control, imagery control and experimental imagery groups for composite PSEC scores at the 0.05 level of probability. Furthermore, ANOVA and Kruskal-Wallis testing between the three groups revealed no significant variations between the three groups for post-intervention composite PSEC scores at the 0.05 level of probability.

Levene tests for Equality of Variances for both pre- and post-intervention measures of composite PSEC were found to be significant at the 0.05 level of probability, casting some doubt on the validity of the ANOVA test. Since the abovementioned research variables did not meet the full requirements for homogeneity of variance, it was decided to further support the ANOVA with a nonparametric analysis of variance, the Kruskal-Wallis One-Way Analysis of Variance. The Kruskal-Wallis does not make an a priori assumption about the specific shape of the sampled population's distribution (Howell, 1997).<sup>4</sup>

Mean difference scores for each group revealed that the standard control group showed a positive improvement in composite PSEC from pre- to post-intervention conditions. However, mean difference scores revealed that the imagery control and experimental imagery groups showed deleterious effects in composite PSEC.

As reflected in Table 8 above, ANOVA and Kruskal-Wallis testing on mean difference scores for each group revealed significant variations between the three groups for composite PSEC at the 0.01 level of probability (ANOVA:  $F(2, 33) = 7.995$ ;  $p < 0.001$  and Kruskal-Wallis: Chi-Square (2) = 12.313;  $p < 0.002$ ). Post-hoc comparisons (Tukey HSD and Scheffe;  $p < 0.05$ ) revealed that the standard control group was significantly different from both the imagery control and experimental imagery groups at the 0.05 and 0.01 level of probability respectively. However, the imagery control

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<sup>3</sup> See Appendix J for Table 15 of significant and non-significant pre- and post-intervention group mean difference scores ( $n = 12$ ) for the Performance Skill Evaluation Chart (PSEC)

<sup>4</sup> There is much debate in the statistical research literature as to whether the inclusion of nonparametric tests is necessary, with some researchers feeling that the ANOVA is sufficiently robust to cope with data which is distributed normally (Howell, 1997). Nevertheless, due to the study's small sample size and for the sake of completeness, it was decided to include the ANOVA's nonparametric equivalent in the present study. However, since the ANOVA has greater power than the Kruskal-Wallis (ibid), it was decided not to rely solely on the Kruskal-Wallis

group was not found to be significantly different from the experimental imagery group at the 0.05 level of probability.

On examination of individual subject mean scores, it was observed that 2/12 (16.67 %) of subjects in the standard control group revealed a deterioration in composite PSEC from pre- to post-intervention conditions. Furthermore, it was observed that 6/12 (50 %) of subjects in the imagery control group and 9/12 (75 %) of subjects in the experimental imagery group revealed detrimental effects in composite PSEC from pre-to post-intervention conditions. The abovementioned deleterious effects in performance ability would account for the disproportionate standard deviations associated with group mean difference scores of composite PSEC.

A Levene test for Equality of Variances for mean difference scores of composite PSEC was found to be non-significant, indicating homogeneity of variance across the three groups at the 0.05 level of probability.

### 4.2.3 Results from the Vividness of Movement Imagery Questionnaire (VMIQ)

*Pre- and post-intervention scores for the Vividness of Movement Imagery Questionnaire for the entire sample (N = 36) and for each group (n = 12)*

**Table 9**

SUMMARY OF DESCRIPTIVE STATISTICS FOR THE VIVIDNESS OF MOVEMENT IMAGERY QUESTIONNAIRE (VMIQ) FOR THE ENTIRE SAMPLE (N = 36) AND FOR EACH GROUP (n = 12)									
	PRE-INTERVENTION			POST-INTERVENTION			MEAN DIFFERENCE		
	COMPOSITE VIVIDNESS OF MOVEMENT IMAGERY								
VARIABLE	n	MEAN	SD	n	MEAN	SD	n (d)	MEAN (d)	SD (d)
1 Standard control	12	81.91	11.73	12	88.48*	6.88	12	6.57	8.20
2 Imagery control	12	72.81	12.59	12	75.25	15.27	12	2.86	9.05
3 Experimental imagery	12	71.24	12.31	12	78.27	14.60	12	7.03	6.43
Entire sample	36	75.32	12.79	36	80.66	13.71	36	5.48	11.01
	EXTERNAL VIVIDNESS OF MOVEMENT IMAGERY								
1 Standard control	12	86.67**	9.12	12	90.14**	7.00	12	3.47	5.70
2 Imagery control	12	71.94	11.07	12	75.71	13.10	12	3.77	9.13
3 Experimental imagery	12	72.77	13.43	12	79.24	14.30	12	6.47	5.52
Entire sample	36	77.13	12.97	36	81.69	13.13	36	4.57	6.92
	INTERNAL VIVIDNESS OF MOVEMENT IMAGERY								
1 Standard control	12	77.15	16.86	12	86.80	11.26	12	9.67	12.00
2 Imagery control	12	73.68	15.57	12	74.65	18.84	12	0.97	11.72
3 Experimental imagery	12	69.70	12.54	12	77.29	15.87	12	7.60	7.69
Entire sample	36	73.51	14.98	36	79.58	16.08	36	6.08	11.01
* indicates significance at a 0.05 level of probability (1-tailed)									
** indicates significance at a 0.01 level of probability (1-tailed)									

As reflected in Table 9 above, mean difference results for the entire sample revealed an overall improvement for all scales of the VMIQ from pre- to post-intervention conditions. The most positive improvement for the entire sample was manifested for the internal VMIQ scale.

ANOVA and Kruskal Wallis testing<sup>5</sup> between the three groups revealed significant differences in pre-intervention group mean scores for external VMIQ at the 0.01 level of probability (ANOVA:  $F(2, 33) = 6.380, p < 0.005$  and Kruskal-Wallis: Chi-Square (2) = 10.980,  $p < 0.004$ ). Post-hoc comparisons (Tukey HSD and Scheffe,  $p < 0.05$ ) confirmed the significance and indicated that the standard control group was significantly different from the imagery control and experimental imagery groups at the 0.01 level of probability. However, the imagery control group was not found to be significantly different from the experimental imagery group at the 0.05 level probability. Therefore, the pre-intervention scores for external VMIQ placed the standard control group at a distinct advantage, relative to the other two groups, prior to the intervention.

As reflected in Table 9 above, ANOVA and Kruskal-Wallis testing between the three groups revealed no significant pre-intervention differences between the standard control, imagery control and experimental imagery groups for composite and internal VMIQ at the 0.05 level of probability. Although non-significant, it was observed that the means for composite VMIQ and internal VMIQ were higher for the standard control group, relative to the other two groups.

Levene tests for Equality of Variances for the all pre-intervention scales of the VMIQ were found to be non-significant, indicating homogeneity of variance across the three groups at the 0.05 level of probability.

As reflected in Table 9 above, ANOVA and Kruskal-Wallis testing revealed significant differences in post-intervention external VMIQ scores (ANOVA:  $F(2, 33) = 4.790, p < 0.015$  and Kruskal-Wallis: Chi Square (2) = 9.882,  $p < 0.007$ ) at the 0.05 and 0.01 level of probability respectively. Post-hoc comparisons (Tukey HSD and Scheffe,  $p < 0.05$ ) indicated that the standard control group was significantly different from the imagery control group at the 0.01 level of probability. However, the standard control group was not found to be significantly different from the experimental imagery group at the 0.05 level of probability. Furthermore, the imagery control group was not found to be significantly different from the experimental imagery group at the 0.05 level of probability on this variable.

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<sup>5</sup> See Appendix K, for Table 16 of significant pre- and post-intervention group mean difference scores ( $n = 12$ ) for the Vividness of Movement Imagery Questionnaire (VMIQ)

Furthermore, ANOVA and Kruskal-Wallis testing revealed significant differences in post-intervention composite VMIQ scores at the 0.05 level of probability (ANOVA:  $F(2, 33) = 3.503$ ,  $p < 0.042$  and Kruskal-Wallis: Chi-Square (2) = 6.977,  $p < 0.031$ ). Post-hoc comparisons (Tukey HSD and Scheffé,  $p < 0.05$ ) revealed that the standard control group was significantly different from the imagery control group at the 0.05 level of probability. However, the standard control group was not found to be significantly different from the experimental imagery group at the 0.05 level of probability. Furthermore, the imagery control group was not found to be significantly different from the experimental imagery group at the 0.05 level of probability.

Levene tests for Equality of Variances for all post-intervention scales of the VMIQ were found to be non-significant, indicating homogeneity of variance across the three groups at the 0.05 level of probability.

ANOVA and Kruskal-Wallis testing on mean difference scores revealed no significant differences across the three groups from pre- to post-intervention conditions for composite, external and internal VMIQ at the 0.05 level of probability.

Levene tests for Equality of Variances for all mean difference scores of the VMIQ were found to be non-significant, indicating homogeneity of variance across the three groups at the 0.05 level of probability.



#### 4.2.4 Results from the Action Control Scale (ACS)

*Pre- and post-intervention scores for the Action Control Scale for the entire sample (N = 36) and for each group (n = 12)<sup>6</sup>*

**Table 10**

SUMMARY OF DESCRIPTIVE STATISTICS FOR THE ACTION CONTROL SCALE (ACS) FOR THE ENTIRE SAMPLE (N = 36) AND FOR EACH GROUP (n = 12)									
	PRE- INTERVENTION			POST-INTERVENTION			MEAN DIFFERENCE		
	COMPOSITE ACTION CONTROL								
VARIABLE	n	MEAN	SD	n	MEAN	SD	n (d)	MEAN (d)	SD (d)
1 Standard control	12	58.33	10.81	12	63.19	12.16	12	4.86	7.23
2 Imagery control	12	51.04	21.55	12	54.17	22.54	12	3.12	11.80
3 Experimental imagery	12	45.83	13.99	12	46.87	15.90	12	1.04	13.89
Entire sample	36	51.74	16.47	36	54.74	18.21	36	3.01	11.12
	COGNITIVE-RELATED ACTION CONTROL								
1 Standard control	12	65.97**	16.46	12	70.83**	15.69	12	4.86	10.33
2 Imagery control	12	47.92	23.06	12	56.25	24.91	12	6.94	17.35
3 Experimental imagery	12	40.97	13.51	12	43.06	18.06	12	2.08	18.84
Entire sample	36	51.62	20.59	36	56.71	22.52	36	4.63	15.61
	BEHAVIOUR-RELATED ACTION CONTROL								
1 Standard control	12	50.69	13.97	12	55.56	15.62	12	4.86	7.50
2 Imagery control	12	54.17	23.71	12	52.08	23.87	12	-2.08	13.82
3 Experimental imagery	12	50.69	15.27	12	50.69	20.55	12	0.00	17.41
Entire sample	36	51.85	17.72	36	52.78	19.82	36	0.93	13.48
	FAILURE-RELATED ACTION CONTROL (AOF)								
1 Standard control	12	68.75	15.94	12	70.83	21.17	12	2.08	8.79
2 Imagery control	12	49.31	27.40	12	54.17	28.54	12	4.86	14.84
3 Experimental imagery	12	50.00	18.46	12	48.61	19.41	12	-1.38	18.06
Entire sample	36	56.02	22.50	36	57.87	24.64	36	1.85	14.24
	DECISION-RELATED ACTION CONTROL (AOD)								
1 Standard control	12	47.92	14.27	12	55.55	16.02	12	7.64	10.33
2 Imagery control	12	52.78	21.42	12	54.17	22.05	12	1.34	17.71
3 Experimental imagery	12	41.67	15.89	12	45.14	17.21	12	3.47	19.61
Entire sample	36	47.45	17.57	36	51.62	18.67	36	4.17	16.12
** indicates significance at a 0.01 level of probability (1-tailed)									

<sup>6</sup> Based on the reliability analyses performed on pre- and post-intervention action control measures, it was decided to delete the AOP subscale from pre- and post-intervention composite ACS to raise the alpha level to a more acceptable level (see p. 33)

As reflected in Table 10 above, mean difference results for the entire sample revealed an overall improvement in all the scales of the ACS from pre- to post-intervention conditions. The most positive improvement was manifested in the cognitive manifestations of ACS from pre-to post-intervention conditions.

ANOVA and Kruskal-Wallis testing<sup>7</sup> between the three groups revealed significant differences in pre-intervention mean scores for cognitive ACS at the 0.01 level of probability (ANOVA:  $F(2, 33) = 6.085$ ;  $p < 0.006$  and Kruskal-Wallis: Chi-Square (2) = 10.7085;  $p < 0.0047$ ). Post-hoc comparisons (Tukey HSD and Scheffe;  $p < 0.05$ ) confirmed this significance and revealed that the standard control group was significantly different from the imagery control group and the experimental imagery group at the 0.05 and 0.01 level of probability respectively. However, the imagery control group was not found to be significantly different from the experimental imagery group at the 0.05 level of probability. The abovementioned significant results for cognitive ACS, indicated that the standard control group was placed at a distinct advantage, relative to the other two groups, prior to the intervention.

ANOVA and Kruskal-Wallis testing between the three groups revealed no significant pre-intervention differences between the standard control, imagery control and experimental imagery groups for the following scales of the ACS: composite ACS, behavioural ACS and subscales AOD and AOF, at the 0.05 level of probability. Although non-significant, it was observed that the results for the abovementioned scales of ACS placed the experimental imagery group at a substantial disadvantage, relative to the other two groups, prior to the intervention.

Levene tests for Equality of Variances for pre-intervention measures of cognitive ACS, subscale AOF and subscale AOD were found to be non-significant, indicating homogeneity of variance across the three groups at the 0.05 level of probability. However, Levene tests for Equality of Variances for pre-intervention measures of composite ACS and behavioural ACS were found to be significant, indicating heterogeneity across the three groups at the 0.05 level of probability. Since the research variables of pre-intervention composite ACS and behavioural ACS did not meet the requirement for homogeneity of variance, the ANOVA results were viewed with caution while the Kruskal-Wallis test was used as a nonparametric equivalent.

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<sup>7</sup> See Appendix L for Table 17 of significant pre- and post-intervention group mean difference scores ( $n = 12$ ) for the Action Control Scale (ACS)

As revealed in Table 10 above, ANOVA and Kruskal-Wallis testing revealed significant differences in post-intervention cognitive ACS scores at the 0.01 level of probability (ANOVA:  $F(2, 33) = 5.827$ ,  $p < 0.007$  and Kruskal-Wallis:  $\chi^2(2) = 9.5657$ ,  $p < 0.0084$ ). Post-hoc comparisons (Tukey HSD and Scheffe,  $p < 0.05$ ) confirmed this significance and revealed that the standard control group was significantly different from the imagery control group and the experimental group. However, the imagery control group was not found to be significantly different from the experimental imagery group at the 0.05 level of probability.

Levene tests for Equality of Variances for all post-intervention scales of the ACS were found to be non-significant, indicating homogeneity of variance across the three groups at the 0.05 level of probability.

Results of ANOVA and Kruskal-Wallis testing on the mean difference scores for all scales of the ACS revealed no significant differences across the three groups, from pre- to post-intervention conditions, at the 0.05 level of probability.

Levene tests for Equality of Variances for all mean difference scores of the ACS were found to be non-significant, indicating homogeneity of variance across the three groups at the 0.05 level of probability.

#### **4.2.5 Additional findings**

In an attempt to isolate the effect of the two alternative modes of imagery interventions, as well as to remove the bias of the more competent control groups, on vividness of movement imagery (VMIQ), action control (ACS) and performance ability (PSEC), further parametric and nonparametric tests were conducted across the imagery control and experimental imagery groups, i.e. excluding the standard control group. Parametric ANOVA testing on all scales of the VMIQ, ACS and PSEC revealed no significant differences between the imagery control and experimental groups at the 0.05 level of probability.

Nonparametric Kruskal-Wallis testing on group mean difference scores for internal VMIQ revealed significant differences between the imagery control and experimental groups from pre- to post-

intervention conditions (Chi-Square (2) = 4.092,  $p < 0.043$ ) at the 0.05 level of probability. Furthermore, Kruskal-Wallis testing on group mean difference scores for composite VMIQ revealed near-significant differences between the imagery control and experimental imagery groups from pre- to post-intervention conditions (Chi-Square (2) = 3.102;  $p < 0.078$ ) at the 0.05 level of probability. Mean ranking between the two groups revealed that the experimental imagery group ranked significantly higher than the imagery control group on group mean difference scores for both internal VMIQ and composite VMIQ at the 0.05 level of probability.

### **4.3 Section two: Results of secondary importance to the study**

Having examined the descriptive and inferential statistics of the pre- and post-intervention score distributions for each instrument, further univariate, bivariate and multivariate statistics were conducted to determine the statistical relationships between the independent, mediating and dependent variables for the entire sample and for each group.

Selected bivariate correlation analyses, using Pearson's product-moment correlation, were performed for the entire sample and for each group to calculate the strength and direction of the relationships between variables of the VMIQ, ACS and the PSEC (see Appendices M, N and O). Thereafter, a Multivariate Analysis of Variance (MANOVA) was conducted to determine how measures of PSEC change from pre- to post-intervention conditions. In particular, MANOVA testing enabled the investigator to include the effects of covariates and covariate interactions with the factors. Two Stepwise Multiple Regression procedures were conducted in order to identify which predictor variables most accounted for variance in post-intervention composite PSEC (all cases,  $N = 36$  and  $N = 24$ ). In order to transform the existing group of variables into a simpler and more useful form, a Factor Analysis was performed. Having obtained two factors, a further Stepwise Multiple Regression<sup>8</sup> was conducted followed by a series of one-way ANOVAs.

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<sup>8</sup> It was noted that in none of the multiple regression analyses, did a second predictor pass the test values to enter the equation (see Tables 11, 12 and 14)

#### **4.3.1 Correlation coefficients for the Vividness of Movement Imagery Questionnaire (VMIQ) and the Performance Skill Evaluation Chart (PSEC) for the entire sample and for each group**

Bivariate correlation analyses were conducted to calculate the strength of the relationships between measures of the VMIQ and the PSEC for the entire sample and for each group<sup>9</sup>.

The results suggested the existence of significant and positive correlations between all post-intervention scales of the VMIQ and the PSEC for the entire sample. In this regard, the strongest correlation was observed between post-intervention composite VMIQ and composite PSEC at the 0.01 level of probability ( $r = 0.46$ ,  $p < 0.005$ ). However, weak and insignificant associations were found between pre-intervention and mean difference scores of the VMIQ and the PSEC.

Bivariate correlation results suggested the existence of significant and inverse relationships between mean difference scores of composite and external subscale measures of the VMIQ and composite PSEC from pre- to post-intervention conditions for the standard control group at the 0.05 level of probability. In this regard, the strongest inverse relationship was observed between mean difference scores of external VMIQ and composite PSEC at the 0.05 level of probability ( $r = -0.61$ ,  $p < 0.035$ ).

Furthermore, bivariate correlation results revealed the existence of significant and near-significant positive associations between external and internal subscale measures of the VMIQ and composite measures of the PSEC across pre- to post-intervention conditions for the imagery control group. In this regard, the strongest relationship was observed between post-intervention internal VMIQ and composite PSEC at the 0.05 level of probability ( $r = 0.6$ ,  $p < 0.038$ ).

Finally, bivariate correlation results revealed near-significant and positive trends between post-intervention and mean difference scores of composite and external subscale measures of the VMIQ and composite PSEC for the experimental imagery group.

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<sup>9</sup> See Appendix M for Tables 18 and 19 of significant correlation coefficients for the Vividness of Movement Imagery Questionnaire (VMIQ) and the Performance Skill Evaluation Chart (PSEC) for the sample ( $N = 36$ ) and for each group ( $n = 12$ )

#### **4.3.2 Correlation coefficients for the Action Control Scale (ACS) and the Performance Skill Evaluation Chart (PSEC) for the entire sample and for each group**

Bivariate correlation analyses were performed to calculate the strength of the relationships between measures of the ACS and the PSEC for the entire sample and for each group.<sup>10</sup>

Bivariate correlation results suggested the existence of a near-significant and positive trend between post-intervention subscale AOD of the ACS and composite PSEC for the entire sample. Furthermore, the results indicated the existence of near-significant and positive trends between mean difference scores of cognitive- and decision-related scores of the ACS and composite PSEC, from pre- to post-intervention conditions. However, pre-intervention measures of the ACS and the PSEC were found to be weakly, and insignificantly associated for the entire sample.

Bivariate correlation results revealed the existence of a significant and inverse relationship between mean difference scores of subscale AOF of the ACS and composite PSEC from pre- to post-intervention conditions for the standard control group at the 0.05 level of probability ( $r = - 0.64$ ,  $p < 0.027$ ).

Furthermore, bivariate correlation results indicated the existence of significant and near-significant positive associations between mean difference scores of composite and cognitive measures of the ACS and composite PSEC from pre- to post-intervention conditions for the imagery control group. In this regard, the strongest relationship was observed between mean difference scores of cognitive ACS and composite PSEC at the 0.05 level of probability ( $r = 0.59$ ,  $p < 0.044$ ).

Finally, bivariate correlation analyses revealed weak and insignificant positive associations between all scales of the ACS and composite PSEC for the experimental imagery group.

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<sup>10</sup> See Appendix N for Tables 20 and 21 of significant correlation coefficients for the Action Control Scale (ACS) and the Performance Skill Evaluation Chart (PSEC) for the sample ( $N = 36$ ) and for each group ( $n = 12$ )

#### **4.3.3 Correlation coefficients for the Vividness of Movement Imagery Questionnaire (VMIQ) and the Action Control Scale (ACS) for the entire sample and for each group**

Bivariate correlation analyses were conducted to calculate the strength of the relationships between measures of the ACS and the VMIQ for the entire sample and for each group.<sup>11</sup>

The results indicated the existence of significant and near-significant positive associations between measures of the VMIQ and the ACS across pre- to post-intervention conditions. The strongest and most frequent correlations were observed between external VMIQ and the following scales of the ACS: composite ACS, cognitive ACS and subscale AOD, across pre- to post-intervention conditions, for the entire sample.

Bivariate correlation results revealed the existence of near-significant and positive trends between measures of the VMIQ and the ACS, across pre- to post-intervention conditions, for both the standard control and imagery control groups.

Furthermore, bivariate correlation results indicated the existence of numerous significant and near-significant positive associations between pre- and post-intervention measures of the VMIQ and the ACS for the experimental imagery group. However, of particular interest were the significant and near-significant positive associations observed between measures of external VMIQ and measures of the ACS across pre- and post-intervention conditions. In this regard, the strongest relationships were observed between pre-intervention measures of external VMIQ and subscale AOD ( $r = 0.64$ ,  $p < 0.026$ ); post-intervention external VMIQ and subscale AOD ( $r = 0.65$ ,  $p < 0.022$ ) and between mean difference scores of external VMIQ and subscale AOF ( $r = 0.65$ ,  $p < 0.022$ ) for the experimental imagery group, at the 0.05 level of probability.

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<sup>11</sup> See Appendix O for Tables 22 and 23 of significant correlation coefficients for the Vividness of Movement Imagery Questionnaire (VMIQ) and the Action Control Scale (ACS) for the entire sample ( $N = 36$ ) and for each group ( $n = 12$ )



#### **4.3.4 Multivariate analysis of variance (MANOVA)**

In order to assess whether performance ability covaried with the other two measures of vividness of movement imagery and action control, it was decided to conduct a MANOVA. Moreover, a MANOVA was performed in view of the two control groups' high scores in vividness of movement imagery and action control, relative to the experimental imagery group.

In the current study, the same dependent variable of performance ability (PSEC) was measured both before and after the instruction intervention ensued. Furthermore, the mediating variables of vividness of movement imagery (VMIQ) and action control (ACS) were specified as variables which covaried with performance ability (PSEC) across the three groups. Therefore, MANOVA testing enabled the investigator to determine how performance ability changed from pre- to post-intervention conditions across the three groups. Of particular importance to this study was that MANOVA testing enabled the investigator to include the effects of covariates and covariate interactions with the factors.

Results of MANOVA testing revealed the following significant "between-subjects effects" for group mean difference scores of composite PSEC: Group effect ( $F = 7.14$ ;  $p < 0.003$ ) and Group  $\times$  Interval interactions ( $F = 4.380$ ;  $p < 0.006$ ) between the three groups within and across both conditions of pre- and post-intervention composite PSEC, at the 0.01 level of probability. These MANOVA results confirm the significant results obtained through ANOVA and Kruskal-Wallis testing discussed earlier (see section 4.2.2). However, the mediating variables of VMIQ and ACS were not found to significantly interact with each other or with the dependent variable of composite PSEC across the three groups, from pre- to post-intervention conditions, at the 0.05 level of probability. Therefore, composite mean difference measures of VMIQ and ACS did not add to the variance of the composite group mean difference scores of composite PSEC.

#### **4.3.5 Stepwise multiple regression**

Having examined the nature of the relationships between variables of interest for the entire sample ( $N = 36$ ) and the three groups ( $n = 12$ ) by means of bivariate correlational analysis, the investigator wished to determine, which elements, of the set of predictor variables most closely predicted the criterion variable of post-intervention composite performance ability (PSEC). For this purpose, a stepwise multiple regression procedure was conducted in order to identify which predictor variable

The first stepwise multiple regression procedure for the sample ( $N = 36$ ) selected post-intervention “external vividness of movement imagery” (subscale of the VMIQ) as the variable which most closely predicted the criterion variable of post-intervention composite PSEC. This variable was chosen on the basis of having the highest correlation with the dependent variable (Multiple  $R = 0.443$ ). Other predictor variables were excluded, as they were not significantly correlated with post-intervention composite PSEC.

The F-Test for the regression equation was found to be significant ( $F(1, 34) = 8.284$ ;  $p < 0.007$ ) at the 0.01 level of probability. As the correlation between the post-intervention external VMIQ and post-intervention composite PSEC was positive ( $r = 0.443$ ), it appeared that high levels of post-intervention external VMIQ most closely predicted high scores on post-intervention composite PSEC. The proportion of variance in post-intervention composite PSEC which was accounted for by post-intervention external VMIQ was about 17% ( $\text{Adj } R^2 = 0.172$ ). Thus, changes in post-intervention external VMIQ could explain a small proportion of the variance in post-intervention composite PSEC. However, there must be other variables beyond that of post-intervention external VMIQ, which could account for 83% of the changes in post-intervention composite PSEC. The results are reflected in Table 11 below.

STEPWISE MULTIPLE REGRESSION ANALYSIS WITH POST-INTERVENTION PERFORMANCE ABILITY AS THE DEPENDENT VARIABLE FOR THE ENTIRE SAMPLE (N = 36)							
DEPENDENT VARIABLE	INDEPENDENT VARIABLE	STEP	R	R SQUARE	ADJUSTED R SQUARE	ANOVA	
						df	F Ratio
Composite performance ability	External vividness of movement imagery	1	0.443	0.196	0.172	(1, 34)	8.284**

\*\* Indicates significance at the 0.01 level of probability

The second stepwise multiple regression procedure across the imagery control and experimental imagery groups ( $N = 24$ ), selected post-intervention “internal vividness of movement imagery” (subscale of the VMIQ) as the IV most highly correlated with the DV of post-intervention composite PSEC (Multiple  $R = 0.483$ ). Other predictor variables were excluded due to poor correlations with post-intervention composite PSEC. A significant association was revealed between post-intervention internal VMIQ and composite PSEC, since the F-Test was significant ( $F(1, 22) = 6.692$ ;  $p < 0.0168$ ) at the 0.05 level of probability. Since the correlation was positive in direction ( $r = 0.48$ ), high levels of post-intervention internal VMIQ most closely predicted high scores on post-intervention composite PSEC. The proportion of variance in post-intervention composite PSEC which was accounted for by post-intervention internal VMIQ was about 20% ( $\text{Adj } R^2 = 0.198$ ). Thus, changes in post-intervention internal VMIQ can explain a fair proportion of the variance in post-intervention composite PSEC across the imagery control and experimental imagery groups only. However, there must be other variables beyond that of post-intervention internal VMIQ which could account for 80% of the variations in post-intervention composite PSEC across the two imagery groups ( $N = 24$ ). The results are reflected in Table 12 below.

**Table 12**

STEPWISE MULTIPLE REGRESSION ANALYSIS WITH POST-INTERVENTION PERFORMANCE ABILITY AS THE DEPENDENT VARIABLE FOR THE TWO IMAGERY GROUPS ( $N = 24$ )							
DEPENDENT VARIABLE	INDEPENDENT VARIABLE	STEP	R	R SQUARE	ADJUSTED R SQUARE	ANOVA	
						<i>df</i>	<i>F Ratio</i>
Composite performance ability	Internal vividness of movement imagery	1	0.483	0.233	0.198	(1, 22)	6.692*
* Indicates significance at 0.05 level of probability							

#### 4.3.6 Additional analyses

##### *Factor analysis*

In order to transform the existing group of variables into a simpler and more useful form, a factor analysis was performed using a principle components solution (orthogonalisation) and varimax rotation (Bernstein, 1988). Two orthogonal factors were determined as a result of the principle components analysis and the varimax rotation allowed the investigator to separate those variables that “belong” to the factor and those that do not. The subcomponent measures of behaviour- and cognitive-related action control as well as the subscale measures of decision- and failure-related action

control were identified as belonging to Factor 1. The subscale measures of external and internal vividness of movement imagery were identified as belonging to Factor 2. The latter results confirm the multiple regressions of the previous pages, in that Factor 2 was, essentially the VMIQ. The identified factors, after varimax rotation, are reflected in Table 13 below.

**Table 13**

FACTOR ANALYSIS AFTER VARIMAX ROTATION			
FACTOR	CLASS OF VARIABLES	VARIABLE	FACTOR LOADING
1	ACTION CONTROL	Failure-related action control (AOF)	0.89
		Behaviour-related action control	0.80
		Cognitive-related action control	0.88
		Decision-related action control (AOD)	0.73
2	VIVIDNESS OF MOVEMENT IMAGERY	External vividness of movement imagery	0.91
		Internal vividness of movement imagery	0.92

#### *Stepwise multiple regression*

Having obtained Factor 1 and Factor 2 as a result of the abovementioned factor analysis, the investigator wished to determine which elements of the set of two factors most closely predicted the criterion variable of post-intervention performance ability (PSEC). For this purpose, a stepwise multiple regression procedure was conducted in order to identify which predictor variable (Factor 1 or 2) most accounted for variance in the criterion variable of post-intervention performance ability (continuous variable,  $N = 36$ ). The stepwise multiple regression procedure selected Factor 2 (external and internal VMIQ) as the variable which most closely predicted the criterion variable of post-intervention composite PSEC. Factor 2 (external and internal VMIQ) was chosen on the basis of having the highest correlation with the dependent variable of post-intervention composite PSEC (Multiple  $R = 0.440$ ). The predictor variable of Factor 1 (subcomponent and subscale measures of the ACS) was excluded, as this factor was not significantly correlated with post-intervention composite PSEC.

The F-Test for the regression equation was found to be significant ( $F(1, 34) = 8.178, p < 0.007$ ) at the 0.01 level of probability. As the correlation between Factor 2 (external and internal VMIQ) and

post-intervention composite PSEC was positive ( $r = 0.440$ ), it appeared that high levels of post-intervention external and internal VMIQ (Factor 2) most closely predicted high scores on post-intervention composite PSEC. The proportion of variance in post-intervention composite PSEC which was accounted for by Factor 2 was about 17% ( $\text{Adj } R^2 = 0.170$ ). Thus, changes in Factor 2 (external and internal VMIQ) could explain a fair proportion of the variance in post-intervention composite PSEC. However, there must be other variables beyond that of post-intervention external and internal VMIQ (Factor 2), which could account for 83% of the changes in post-intervention composite PSEC. The results are reflected in Table 14 below.

**Table 14**

STEPWISE MULTIPLE REGRESSION ANALYSIS UTILISING FACTORS 1 AND 2 AS THE PREDICTOR VARIABLES AND POST-INTERVENTION PERFORMANCE ABILITY AS THE CRITERION VARIABLE FOR THE ENTIRE SAMPLE (N = 36)							
DEPENDENT VARIABLE	INDEPENDENT VARIABLE	STEP	R	R SQUARE	ADJUSTED R SQUARE	ANOVA	
						df	F Ratio
Composite performance ability	Factor 2 (external and internal VMIQ)	1	0.440	0.194	0.170	(1, 34)	8.178**
** Indicates significance at the 0.01 level of probability							

#### *One-way analyses of variance*

As a final analysis, the sample of subjects ( $N = 36$ ) were divided into two groups on the basis of each subject's positive or negative group mean difference scores for performance ability. Subjects with positive group mean difference scores were placed in Group 1 ( $n = 17$ ) while subjects with negative group mean difference scores were placed in Group 2 ( $n = 19$ ). In order to determine whether any significant variations existed between Group 1 and Group 2, a series of one-way ANOVAs were performed for composite and subcomponent measures of the VMIQ as well as composite, subcomponent and subscale measures of the ACS from pre- to post-intervention conditions. The results of ANOVA testing revealed no significant differences between Group 1 and Group 2 for all measures of the VMIQ and ACS at the 0.05 level of probability from pre- to post-intervention conditions.

## 4.4 Summary of significant results

### 4.4.1 Section one: Results of primary importance to the study

#### Performance Skill Evaluation Chart (PSEC)

##### *Parametric and nonparametric testing across pre- to post-intervention conditions*

- ❑ ANOVA and Kruskal-Wallis testing revealed significant differences across the three groups for mean difference scores of composite PSEC (ANOVA:  $F(2, 33) = 7.995$ ,  $p < 0.001$  and Kruskal-Wallis: Chi-Square (2) = 12.313,  $p < 0.002$ ), in favour of the standard control group, at the 0.01 level of probability. In particular, the standard control group revealed a positive improvement in composite PSEC ( $M(d) = 4.73$ ,  $SD(d) = 4.12$ ) while the imagery control ( $M(d) = -0.76$ ,  $SD(d) = 6.07$ ) and experimental imagery groups ( $M(d) = -3.10$ ,  $SD(d) = 4.35$ ) revealed deteriorations in composite PSEC

#### The Vividness of Movement Imagery Questionnaire (VMIQ)

##### *Parametric and nonparametric testing across pre- and post-intervention conditions*

- ❑ ANOVA and Kruskal-Wallis testing revealed significant differences in pre- and post-intervention scores for external VMIQ in favour of the standard control group (pre-intervention: ANOVA:  $F(2, 33) = 6.380$ ,  $p < 0.005$  and Kruskal-Wallis: Chi-Square (2) = 10.980,  $p < 0.004$  and post-intervention: ANOVA:  $F(2, 33) = 4.790$ ,  $p < 0.015$  and Kruskal-Wallis: Chi-Square (2) = 9.882,  $p < 0.007$ ) at the 0.01 level of probability
- ❑ ANOVA and Kruskal-Wallis testing revealed significant differences in post-intervention composite VMIQ (ANOVA:  $F(2, 33) = 3.503$ ,  $p < 0.015$  and Kruskal-Wallis: Chi-Square (2) = 6.977,  $p < 0.007$ ) in favour of the standard control group, at the 0.05 and 0.01 level of probability respectively

#### The Action Control Scale (ACS)

##### *Parametric and nonparametric testing across pre- and post-intervention conditions*

- ❑ ANOVA and Kruskal-Wallis testing revealed significant differences in pre- and post-intervention mean scores of cognitive ACS in favour of the standard control group (pre-intervention: ANOVA:  $F(2, 33) = 6.085$ ,  $p < 0.006$  and Kruskal-Wallis: Chi-Square (2) = 10.7085,  $p < 0.0047$  and post-intervention: ANOVA:  $F(2, 33) = 5.827$ ,  $p < 0.007$  and Kruskal-Wallis: Chi-Square (2) = 9.5657,  $p < 0.0084$ ) at the 0.01 level of probability

### Additional findings

- ❑ Kruskal-Wallis testing revealed significant differences across the imagery control and experimental imagery groups for mean difference scores of internal VMIQ (Chi-Square (2) = 4.092,  $p < 0.043$ ), in favour of the experimental group, at the 0.05 level of probability

### **4.4.2 Section two: Results of secondary importance to the study**

#### Significant correlations observed between measures of the VMIQ and the PSEC:

- ❑ Significant and positive correlations were observed between post-intervention measures of the VMIQ and the PSEC for the entire sample
- ❑ A significant inverse relationship was observed between mean difference scores of composite and external subscale measures of the VMIQ and composite PSEC for the standard control group ( $r = -0.61$ ,  $p < 0.035$ )
- ❑ A significant and positive correlation was observed between post-intervention measures of internal VMIQ and PSEC for the imagery control group ( $r = 0.60$ ,  $p < 0.038$ )

#### Significant correlations observed between measures of the ACS and the PSEC:

- ❑ A significant and inverse correlation was observed between mean difference scores of subscale AOF of the ACS and PSEC for the standard control group ( $r = -0.64$ ,  $p < 0.027$ )
- ❑ A significant and positive correlation was revealed between mean difference scores of cognitive ACS and PSEC for the imagery control group ( $r = 0.59$ ,  $p < 0.044$ )

#### Significant correlations observed for measures of the VMIQ and the ACS:

- ❑ Significant and positive correlations were observed between external VMIQ and the following scales of the ACS: composite ACS, cognitive ACS and subscale AOD, across pre- to post-intervention conditions, for the entire sample
- ❑ Significant and positive correlations were observed between external VMIQ and the following scales of the ACS: composite ACS, behavioural ACS and subscales AOD and AOF, across pre- to post-intervention conditions, for the experimental imagery group

#### Stepwise Multiple Regression

- ❑ A preliminary Stepwise Multiple Regression equation for the sample ( $N = 36$ ) selected post-assessment “external vividness of movement imagery” as the variable which most closely predicted post-intervention composite PSEC

- ❑ A further Stepwise Multiple Regression equation for the sample ( $N = 24$ ), ie: excluding subjects from the standard control group ( $n = 12$ ), identified post-intervention “internal vividness of movement imagery” as the variable which most closely predicted post-intervention composite PSEC

#### Further analyses

##### *Factor Analysis*

- ❑ A Factor Analysis (principle components solution and varimax rotation) identified two orthogonal factors : Factor 1 was defined by subcomponent and subscale measures of the ACS. Factor 2 was defined by subcomponent measures of the VMIQ

##### *Stepwise Multiple Regression*

- ❑ Utilising Factor 1 and Factor 2 as predictor variables, a Stepwise Multiple Regression equation identified Factor 2 (external and internal VMIQ) as the variable which most closely predicted the criterion variable of post-intervention composite PSEC



## **CHAPTER FIVE**

### **DISCUSSION**

#### **5.1 Introduction**

The primary focus of this study was to explore the effects of ecological self representational imagery on performance ability in young ballet dancers. Of secondary importance was the nature, magnitude and direction of the relationship between vividness of movement imagery, action control and performance ability.

This chapter considers the results of the study, with reference to the literature on Gibson's (1979) ecological approach to perception and mental imagery, and their relationship to action control (Kuhl, 1985) and performance ability. Furthermore, since the current study identified young adolescent ballet dancers (aged 11-13), the developmental implications of the findings will be considered and discussed. As the statistical treatment was both causal and correlational, the study aimed to attribute causality to the independent variable as well as to explore the relationships between the predictor and criterion variables in the ensuing discussion. The chapter will conclude with a discussion of the study's limitations and recommendations for future research.

In terms of the literature reviewed in chapter 2, one would predict the experimental imagery group to be positively and significantly different from the imagery control and standard control groups with respect to performance ability, vividness of movement imagery and action control, from pre- to post-intervention conditions. This is reflected in the principle and secondary research hypotheses of the study. Furthermore, the relationships between measures of vividness of movement imagery, action control and performance ability were expected to be significantly correlated. The principle and secondary research hypotheses will now be explored in relation to the results of the study.

## 5.2 Section one: Discussion of findings of primary importance to the study

The principle research hypothesis of the study predicted that there would be significant differences in measures of performance ability between the three groups, in favour of the experimental imagery group. However, contrary to what was expected, descriptive results revealed a minimal improvement in performance ability for the entire sample, from pre- to post-intervention conditions. Furthermore, one-way ANOVAs ( $F = 7.995$ ,  $p < 0.001$ ), their nonparametric equivalents (Kruskal-Wallis: Chi-Square = 12.313,  $p < 0.002$ ) as well as MANOVA results (Group effect:  $F = 7.14$ ,  $p < 0.003$  and Interaction effect:  $F = 4.380$ ,  $p < 0.006$ ) revealed significant differences in performance ability, in favour of the standard control group, from pre- to post-intervention conditions, at the 0.01 level of probability. Thus, the abovementioned significant results were contrary to the predicted research hypothesis since the standard control revealed a significant and positive improvement in performance ability while the imagery control and experimental imagery groups revealed unexpected deteriorations in performance ability, from pre- to post-intervention conditions.

The abovementioned unexpected and inconsistent results in performance ability may be partially attributed to the results of secondary research hypotheses 2 and 3 reflected below.

Secondary research hypothesis 2 predicted that there would be significant differences in vividness of movement imagery between the three groups, in favour of the experimental imagery group. However, one-way ANOVAs and their nonparametric equivalents, revealed no significant differences between the three groups for vividness of movement imagery, from pre- to post-intervention conditions.

Despite subject randomisation, the results indicated significant differences between the three groups for pre-intervention scores of external vividness of movement imagery, in favour of the standard control group (ANOVA:  $F(2, 33) = 6.380$ ,  $p < 0.005$  and Kruskal-Wallis: Chi-Square (2) = 10.980,  $p < 0.004$ ), at the 0.01 level of probability. As a probable consequence of the abovementioned significant pre-intervention scores of external vividness of movement imagery, ANOVA and Kruskal-Wallis testing revealed significant differences in post-intervention scores of external vividness of movement imagery, in favour of the standard control group (ANOVA:  $F(2, 33) = 4.780$ ,  $p < 0.015$  and Kruskal-Wallis: Chi-Square (2) = 6.977,  $p < 0.031$ ), at the 0.05 level of probability.

The abovementioned significant results obtained for post-intervention scores of external vividness of movement imagery, in favour of the standard control group, may have been strongly influenced by the significant results obtained on the pre-intervention scores of external vividness of movement imagery. However, a different perspective might be that the standard instruction intervention had the capacity to engage the subjects' innate ability to image the performance of the task (single *pirouette en dehors*) from an external perspective. This being the case, it may be argued that the standard instruction intervention did indeed have the most positive effect on the subjects' ability to image movements vividly from an external perspective, i.e. when a person views him or herself from the perspective of an external observer (Mahoney, 1979 cited in Perry & Morris, 1995). According to Hinshaw (1991), external images are quite different in that the subject "watches" him/herself perform the activity as if on videotape. External imagery typically involves no kinesthetic sensation; the subject is somewhat removed from and not personally involved in the "action" of the imager (p.12).

Furthermore, it would seem that despite pre-experimental subject randomisation into three groups, pre-intervention results were consistently skewed in favour of the standard control group on composite, external (significant) and internal scales of the VMIQ. In this regard, the results indicated that the imagery control and experimental imagery groups were placed at a distinct and sometimes significant disadvantage, prior to the intervention procedure, on composite, external (significant) and internal scales of the VMIQ. As discussed above, subjects in the standard control group were significantly more skilled at imaging movements from an external perspective, relative to the other two groups. Schick (1970) discovered that it is the external imagery style that is most widely used by subjects in the absence of prior experience or instruction (cited in Hinshaw, 1991). Furthermore, although non-significant, the results indicated that the standard control group was also more competent at imaging movements from an internal perspective, relative to the two imagery groups. Therefore, regardless of randomisation procedures, subjects in the standard control group possessed an overall (composite) ability to image movements more vividly in relation to the two imagery groups, prior to the intervention procedure.

Overall, the scientific experimental evidence in support of imagery is impressive and clearly demonstrates the value of imagery in learning and performing motor skills (Feltz & Landers, 1983; Richardson, 1967; Weinberg, 1981 cited in Weinberg & Gould, 1995). Therefore, based on the

current literature it may be argued that the significant and positive variations in performance ability, in favour of the standard control group, may be partially attributed to this group's inherent and superior composite, external (significant) and internal ability to image movements more vividly, prior to the intervention procedure.

Additional nonparametric testing revealed significant differences between the imagery control and experimental imagery groups for mean difference scores of internal vividness of movement imagery (Kruskal-Wallis: Chi-Square (2) = 4.092,  $p < 0.043$ ), at the 0.05 level of probability. The results indicated that the experimental imagery intervention had the most significant and positive effect on the use of internal vividness of movement imagery, relative to the imagery control group. This significant result, in favour of the experimental imagery group, is particularly noteworthy since the experimental imagery group was placed at a substantial disadvantage, prior to the experimental imagery intervention.

The abovementioned results suggest that the imagery intervention with affordance saliency had the most positive effect on the subjects' ability to image movements from an internal perspective, i.e. an approximation of the real-life experience such that a person actually feels those sensations which might occur while participating in the real situation (Mahoney, 1979 cited in Perry & Morris, 1995). According to Hinshaw (1991), the performer imaging from an internal perspective actually "feels" the image, experiencing the kinesthetic sensations as if she/he were actually performing the task in the image. Ideally, all senses are tuned as they would be in the real situation. For example, in the current study the ballet dancer would attempt to "hear" and "feel" the spinning action of the single *pirouette en dehors*, "seeing" the spatial dimensions of the studio from the perspective of the dancer.

Therefore, in support of secondary research hypothesis 2, the results indicated that the experimental imagery intervention had the capacity to significantly and positively influence the subjects' capacity to image movements vividly from an internal perspective, relative to subjects in the imagery control group. However, despite the above significant advantage, the unexpected results in performance ability suggest that the experimental imagery group's superior internal imaging ability was not translated into the predicted positive performance benefits.

A variety of studies have examined the effects of mental imagery as they relate to internal versus

external images (Hinshaw, 1991). The majority of the literature supports the premise that mental practice works best when using images from an internal perspective. In a study of gymnasts at an Olympic qualifying competition, Mahoney and Avenier (1977) found that imaginal style was one variable by which one could differentiate qualifiers from nonqualifiers; qualifiers exhibited a significantly larger proportion of internal images as compared to nonqualifiers (cited in Hinshaw, 1991). However, Hinshaw (1991) points out that one must consider that it is virtually impossible to distinguish or delineate completely “internal” from “external” images since every image contains varying degrees of both components at different stages of the image. Thus, the relationship of mental practice and imaginal style is dependent on both the nature of the image and on the imaginal style of the individual.

Secondary research hypothesis 3 predicted that there would be significant differences in action control between the three groups, in favour of the experimental imagery group. However, one-way ANOVAs, as well as their nonparametric equivalents, revealed no significant differences in action control, from pre- to post-intervention conditions.

Despite subject randomisation, the results indicated significant differences between the three groups for pre-intervention scores of cognitive-related action control, in favour of the standard control group (ANOVA:  $F(2, 33) = 6.085$ ,  $p < 0.006$  and Kruskal-Wallis: Chi-Square (2) = 10.7085,  $p < 0.0047$ ), at the 0.01 level of probability. As a probable consequence of the abovementioned significant pre-intervention results, ANOVA and Kruskal-Wallis testing revealed significant differences in post-intervention scores for cognitive-related action control, in favour of the standard control group (ANOVA:  $F(2, 33) = 5.827$ ,  $p < 0.007$  and Kruskal-Wallis: Chi-Square (2) = 9.5657,  $p < 0.05$ ), at the 0.01 and 0.05 level of probability respectively.

The significant results obtained for post-intervention scores of cognitive-related action control, in favour of the standard control, may have been strongly influenced by the significant results observed for pre-intervention scores of cognitive-related action control. However, a different perspective may be that the standard instruction did indeed have the most significant and positive effect on the subjects' cognitive manifestations of action control. In this regard, it may be argued that subjects of this developmental age (11 - 13 years) and stage (adolescence) may have been more accustomed and

therefore, more responsive, to the directive nature of the standard instruction intervention. In view of the above, it may be understandable that subjects in the standard control group displayed more enhanced cognitive-related action control strategies, after the standard instruction intervention ensued.

Furthermore, the results indicated that, regardless of subject randomisation, a substantial proportion of the pre-intervention action control measures were skewed in favour of the standard control group for composite, cognitive- (significant) and failure-related action control, relative to the two imagery groups. Therefore, it may be argued that subjects in the standard control group revealed the most efficient action control strategies, in relation to the two imagery groups, prior to the intervention procedure. In this regard, subjects in the standard control group revealed a significant predisposition towards cognitive over behavioural manifestations of action control. Furthermore, subjects in the standard control group revealed a preference for failure-related action control over decision-related action control.

In light of the above, it is probable that subjects in the standard control group were more likely to perform the intended action through the use of composite, cognitive and failure-related action control processes such as active attentional selectivity, encoding-control, emotional-control and environmental-control (Kuhl, 1985; Kendzierski, 1990). Therefore, it may be argued that the significant and positive variations in performance ability, in favour of the standard control group, may be partially attributed to this group's inherent ability to adopt an action control approach, i.e. the ability to strengthen and protect the current action until it was performed (Beckmann & Kuhl, 1984).

The abovementioned pre-intervention scores in favour of the standard control group point strongly to problems with the research design, methodology and logistics of the research which may have contributed to the somewhat unexpected and inconsistent results in performance ability.

It would seem that the method of random assignment utilized in the current study inadvertently resulted in an uneven distribution of subject characteristics between the three groups in terms of performance skill, imaging ability and action orientation, prior to the intervention taking place. As already discussed, the results indicated that post-intervention measures of performance ability may have been confounded by elevated pre-intervention scales of vividness of movement imagery and

action control, in favour of the standard control group. Furthermore, subjective scanning of the initial qualitative data gathered from the administration of brief semi-structured interviews to the individual subjects, suggested that subjects in the standard control group were of a superior intellectual ability and cognitive intelligence, relative to the other two groups. Finally, other subject characteristics of particular concern and relevance to the results of the study are that of age and developmental stage (the latter point will be elaborated on in the ensuing discussion). The abovementioned confounding variables point strongly to the need for a pre-experimental subject screening, assessment and matching procedure, prior to subject randomisation. In this way, variations in performance skill, imaging ability and action orientation could be better controlled for before subject randomisation, thereby promoting a more homogenous sample of subjects.

Of further concern to the current study are the significant and deleterious effects of the imagery control and, in particular, the experimental imagery intervention on performance ability, relative to the standard control group. In particular, 6/12 (50%) of the subjects in the imagery control group and 9/12 (75%) of subjects in the experimental imagery group revealed detrimental effects in performance ability from pre- to post-intervention conditions. Besides the abovementioned elevated pre-intervention scores in favour of the standard control group, further research design, methodological and practical limitations may have substantially contributed to the negative mean difference scores in performance ability, as revealed by the imagery control and experimental imagery groups. In this regard, the current study utilised a sample of pubescent subjects in varying stages of maturation, exposed them to a 45 minute imagery intervention, and then proceeded to measure the effects of alternative modes of imagery on performance ability. However, according to Suinn (1993), using mental imagery appropriately is a type of mental skill. Thus, if imagery as a tool for performance enhancement is to have maximal effects, adequate skill development is necessary through regular exposure to imagery practice and rehearsal. Thus, it may be argued that the short term nature of the current study's research design failed to take Suinn's proposition into account with assumptions being made that all participants were equally skilled in developing, controlling and using imagery. Furthermore, Suinn (1993) cautions that if the capacity to image is not adequately developed, performance ability may be initially hindered. This point serves to confirm our understanding of imagery generation and application in that should one want to teach imagery skills, "a once off approach", as often happens in some interventions, could actually lead to a deterioration

in performance skill.

The age (11 - 13 years) and developmental stage of the subjects is another important factor which may have further contributed to the somewhat unexpected and varied results in performance ability across the three groups. According to Beunen and Malina (1996), peak velocity in growth structure is attained at age 12 (for females). Therefore, it may be argued that the subjects were at the height of adolescent development at the time of the experimental procedure. Furthermore, Thomas, Thomas and Gallagher (1993), maintain that changes in motor performance during adolescence are highly variable and do not necessarily occur at the same rate. Therefore, it may be argued that the age and developmental stage of the subjects may be an important confounding variable to consider in light of the current study's highly variable results.

Despite the relatively narrow range in subject age (11 - 13 years), it may be argued that chronological age, as an indicator of individual maturity status, had limited utility for the current study. According to Beunen and Malina (1996), there is considerable variability in physical characteristics among individuals of the same chronological age, especially during the pubertal years. Furthermore, the process of growth and biological maturation are related and both had the potential to influence the physical performance of the subjects.

Thomas et al (1993) maintain that cognitive processes operate in movement as they do for any type of skill or knowledge. However, Thomas et al (1993) assert that it is important to consider that knowing and executing are not the same thing. In this regard, it may be argued that age-related issues such as speed of information processing, perceptual development and memory strategies may have undermined and/or interfered with the effects of the imagery control and, in particular, the experimental imagery interventions on performance ability. It is further speculated that subjects in the abovementioned two groups may have been particularly sensitive and/or vulnerable to interference effects since active emphasis was placed on the utilization of cognitive and selective attention strategies as opposed to behavioural execution/correction to enhance performance ability.

With reference to speed of information processing, it is speculated that subjects in the imagery control and experimental imagery groups may not have been given adequate time for information



processing. According to Gallagher and Thomas (1980), if the information processing interval is limited, motor performance in children will be hindered, not because they cannot perform the task, but because they have not been given enough time to “think” about what they need to do (cited in Thomas et al, 1993). Therefore, the duration of the imagery intervention may be an important variable to consider when administering group interventions with adolescent children using imagery.

With regards to perceptual development, Thomas and Thomas (1987) concluded that children should not be assumed to perceive the same level of information as an adult. The result is that a child may think that the movement has been effectively produced, when in fact it has not (cited in Thomas et al, 1993). Based on the above theoretical principles, it may be argued that the research design did not adequately take into account perceptual developmental limitations with assumptions being made that the perception of an adolescent is on par with that of an adult. Paradoxically, the limitations of the current study’s research design has given one, through unexpected negative results, some important implications for future imagery interventions with adolescent females.

The above argument may hold credence when applied to the imagery control intervention. However, if one considers the Gibsonian principles underpinning the experimental imagery intervention, this argument becomes less tenable: Neisser’s (1995) conception of the ecological self is put forward as the first of five types of self knowledge which develop throughout the lifespan. Both the ecological and social forms of self knowledge are preconceptual and perceptual aspects of self which are fundamental for the development of late, more sophisticated aspects of conceptual self. Thus, it may be argued that if one seeks to explore and enhance the potential of ecological self construction by means of affordance salient imagery processes, one is surely activating deep, primal and fundamental cognitive structures which have originated during the first few months of infancy. Although it is acknowledged that a developmental shift occurs in perception, it may be argued that the ecologically relevant imagery intervention may have accessed more foundational and/or primary cognitive structures of which the subjects were unaware. However, due to the short term nature of the current study’s research design, gains in ecological self representation were not translated into performance benefits through adequate practice and subsequent learning.

Another important developmental consideration is that of selective attention. According to Ross

(1976), selective attention serves in the perceptual encoding of task-appropriate cues and as a control process to continually maintain relevant information in working memory. The development of selective attention includes three levels: overexclusive, overinclusive and selective attention. The overinclusive child (between 6 - 7 years and 11 - 12 years) directs attention to the entire display without focussing on task-appropriate cues. At *approximately* age 11, the child develops the ability to selectively attend to task-appropriate cues and ignore irrelevant information (cited in Thomas et al, 1993). It may be argued that the ability to selectively attend to task-appropriate cues would be an especially important attribute for subjects in the experimental imagery group. In the spirit of Gibson's direct perception theories, it is argued that the "perceiver", through the medium of an ecologically relevant imagery intervention, will need to selectively attend to variables and invariants of interactive information so that possibilities for action can be co-perceived (Bermudez et al, 1995). However, it is speculated that subjects in the experimental imagery group, by virtue of their pubescent maturity status, may not have fully established and/or stabilised the ability to selectively attend to ecologically relevant task-appropriate cues.

Furthermore, it is speculated that possible high anxiety levels in the subjects may have led to attentional problems thereby interfering with the perceptual encoding of salient ecological information. Therefore, a research design which takes into account the interaction between physiological and psychological components of performance ability, including pre- and post-intervention assessments of arousal and anxiety levels, would contribute to our understanding of the interrelations between the various components (see section 5.5 for further elaboration).

The above being the case, it may be argued that the affordance salient imagery intervention may have functioned to destabilize the perceived "animal-environment fit". By making salient those physical aspects of the environment to a subject functioning in an overinclusive or a transitional stage of selective attention, the subject may have perceived that the demands of the environment outweigh the abilities of the subject, resulting in high test anxiety and associated high-ruminating state orientation (Kuhl & Grosse, 1983 cited in Kuhl, 1984). Furthermore, according to Hinshaw (1991), when an individual has failed to establish her/his "ideal performing state" (incorporating appropriate personal levels of anxiety, stress and arousal), mental practice may not be at a maximum effectiveness (p.7). Furthermore, an individual at a less than ideal level of arousal is likely to have poor feelings

of self-efficacy (Bandura, 1982; Perry & Morris 1995; van der Westhuizen & Basson, 1997). Thus, it may be argued that subjects functioning in the adolescent stage of development, may have experienced the experimental imagery intervention as potentially threatening and overwhelming to their perceived ability as revealed by nine out of the twelve subjects.

In the above regard, it was interesting to observe, that in relation to the other two groups, the experimental imagery intervention had a deleterious effect on failure-related action control, a moderate effect on decision-related action control, a minimal effect on cognitive-related action control and little or no effect on behaviour-related action control. Therefore, it may be argued that after the experimental imagery intervention ensued, subjects presented with poor action control and associated high-ruminating and vacillating state orientation (Kuhl, 1985). Thus, based on current theoretical principles, it could be suggested that subjects in the experimental imagery group were particularly vulnerable to high test anxiety (Kuhl & Grosse, 1983 cited in Kuhl, 1984), low focus and poor percepts of self-efficacy (Bandura, 1982; Perry & Morris 1995; van der Westhuizen & Basson, 1997). Therefore, it may be argued that after the ecologically relevant imagery intervention had ensued, subjects failed to establish their “ideal performing state” (Hinshaw, 1991, p.7) which may have significantly and negatively interfered with the enactment of the gross motor task, i.e. *single pirouette en dehors*.

An opposite perspective applied to the standard control group. Relative to the experimental imagery intervention, the standard control instruction intervention revealed an intermediate and positive effect on failure-related action control; the most positive effect on decision-related action control; the most positive effect on behaviour-related action control and an intermediate and positive effect on cognitive-related action control. Therefore, it could be argued that from pre- to post-intervention conditions, subjects in the standard control group presented with high action control and associated high focus, low test anxiety and strong percepts of self-efficacy. Therefore, the abovementioned positive effects in action control may have translated into significant and positive performance benefits, as revealed by ten out of the twelve subjects. It may be speculated that subjects in the adolescent stage of development may have been more responsive to the more familiar instructional and directive nature of the standard control intervention and more vulnerable to distractions and interferences during the relaxation and cognitive-motor components of the conventional and

experimental imagery interventions.

Mean difference scores of action control for the imagery control group were highly variable and inconsistent. Relative to the other two groups, the imagery control intervention revealed the strongest improvement in failure-related action control; the least improvement in decision-related action control; the strongest improvement in cognitive-related action control and a deleterious effect in behaviour-related action control. Although possible and independent explanations for each of these effects may be put forward, it is the submission of the investigator that the above inconsistent results are a reflection of the concern that subjects were assessed while in the highly variable developmental stage of adolescence. It is therefore difficult to ascertain the intrinsic effects of the conventional imagery and other interventions on action control measures.

### **5.3 Section two: Discussion of findings of secondary importance to the study**

Additional emerging trends and relationships between the variables of performance ability, vividness of movement imagery and action control will be examined in relation to the additional findings of univariate, bivariate and multivariate statistics. It should be noted, however, that the bivariate correlational type of design is one of the weakest used in the investigation of imagery in sport. According to Heyman (1982), a central problem is that causality between certain cognitive strategies and performance is implied where none may exist. Therefore, the reader is cautioned against interpreting the ensuing discussion of correlational findings as causal in nature.

The nature and scope of the relationship between vividness of movement imagery and performance ability will now be discussed and explored.

The relationship between pre- and post-intervention measures of vividness of movement imagery and performance ability, for the entire sample and for each group, was partially supported by both correlational and causal analyses. In this regard, two stepwise multiple regression procedures selected post-intervention “external vividness of movement imagery” for the entire sample ( $N = 36$ ) and “internal vividness of movement imagery” across the two imagery groups ( $N = 24$ ) as the variables which most closely predicted performance ability.

Based on the above results, it may be suggested that for the entire sample ( $N = 36$ ), the intervention procedure revealed the existence of high scores in external vividness of movement imagery which were associated with high scores in performance ability. In this regard, Schick (1970) discovered that it is the external imagery style that is most widely used by subjects in the absence of prior instruction. Furthermore, according to Hinshaw (1991), people tend to vary greatly in what they actually imaged; in some cases, people discovered that they were forming images of other people, not of themselves.

The above results also suggested that the two imagery interventions ( $N = 24$ ), had the capacity to stimulate high scores in internal vividness of movement imagery which were associated with high scores in performance ability. In line with the above results, the majority of literature supports the premise that mental practice works best when using images from an internal perspective (Epstein, 1980).

Consistent with the strong inter-item correlation results obtained for the Vividness of Movement Imagery Questionnaire (VMIQ) and the Action Control Scale (ACS) (see sections 3.7.2 and 3.7.3 respectively), a factor analysis identified two orthogonal factors, for the entire sample: Factor 1 (all scales of the ACS) and Factor 2 (all scales of the VMIQ). Thereafter, a stepwise multiple regression procedure selected "Factor 2" (external and internal vividness of movement imagery) as the variable which most closely predicted mean difference scores of performance ability, for the entire sample. Thus, it may be suggested that the intervention procedure induced high scores in Factor 2 (external and internal vividness of movement imagery) which closely predicted high scores in performance ability, for the entire sample.

However, it was also acknowledged that there must be other mediating factors beyond that of external and internal vividness of movement imagery which may have accounted for the variations in performance ability.

In confirmation of the above findings, bivariate correlation results revealed the existence of significant and positive correlations between post-intervention external ( $r = 0.44$ ,  $p < 0.007$ ) and internal ( $r = 0.43$ ,  $p < 0.010$ ) measures of vividness of movement imagery and performance ability, for the

entire sample, at the 0.01 and 0.05 level of probability respectively.

The abovementioned significant results support the results of previous research in the field of imagery generation and application in sport performance (Cox, 1994; Perry & Morris, 1995; Solso, 1979; Suinn, 1993 and Suler 1996). Summarising the current research findings on the effectiveness of mental imagery in sport performance, Perry and Morris (1995) contend that although the use of mental imagery improves performance, the details of the processes and mechanisms involved in mental imagery use have not been fully explicated.

Finally, other interesting and significant bivariate correlations between vividness of movement imagery, action control and performance ability, of relevance to the current study, will now be discussed and explored.

Interestingly, bivariate correlation results conducted for each group suggested the existence of a highly significant but inverse relationship between mean difference scores of external vividness of movement imagery and performance ability, for the standard control group, at the 0.05 level of probability ( $r = -0.61, p < 0.035$ ). Furthermore, the standard control group revealed a near-significant but inverse trend between mean difference scores of composite vividness of movement imagery and performance ability ( $r = -0.54, p < 0.069$ ). It may be speculated that high scores in composite vividness of movement imagery and, in particular, external vividness of movement imagery, may have been associated with low scores in composite performance ability.

A number of studies have found a negative relation between external imagery and performance, suggesting that the external focus increases the influence of environmental factors (Hinshaw, 1991). This association with an awareness of the environment may lead to increased self-consciousness, heightened nervousness (Epstein, 1980) and poor self-efficacy (Bandura, 1982; Perry & Morris, 1995) that may hinder performance (van der Westhuizen & Basson, 1997). Hale (1982) found that external imagery lacked the concomitance with localized muscular movement that was found with internal imagery and that appeared to be a mechanism by which performance was aided.

Further bivariate correlation analyses suggested the existence of a significant and positive association

between mean difference scores of internal vividness of movement imagery and composite performance ability, for the imagery control group ( $r = 0.60$ ,  $p < 0.038$ ). It may be tentatively put forward that the imagery control intervention may have had the capacity to stimulate high scores in internal vividness of movement imagery which may have been positively associated with high scores in performance ability, from pre- to post-intervention conditions.

However, the above significant and near-significant relationships observed between vividness of movement imagery and performance ability, for the entire sample and for each group, should be interpreted with extreme caution (Heyman, 1982). Furthermore, Murphy and Jowdy (1992) caution that studies of the imagery-performance relationship have generated many more questions than have been answered. According to Murphy and Jowdy (1992), several studies have examined correlations between psychological test scores and various performance measures, such as coach ratings (Carpinter & Cratty, 1983; Gould, Weiss & Weinberg, 1981; Highlen & Bennett, 1979, 1983; Meyers, Cooke, Cullen & Liles, 1979; Rotella, Gansneder, Ojala & Billing, 1980 cited in Murphy & Jowdy, 1992). In general, these studies have suggested that successful athletes may be more likely than their unsuccessful counterparts to engage in such mental processes such as dreaming successfully about their events, using internal imagery, and using imagery as a problem-solving strategy. In several instances, however, the results obtained across studies were contradictory, and clear-cut patterns were difficult to distinguish.

Interestingly, the standard control and imagery control groups revealed the existence of significant correlations between action control and performance ability. In this regard, bivariate correlation results revealed a significant but inverse relationship between mean difference scores for failure-related action control and composite performance ability, for the standard control group ( $r = -0.64$ ,  $p < 0.027$ ). It may be tentatively put forward that high scores in failure-related action control may be negatively associated with low scores in performance ability, for the standard control group. However, the negative relationship obtained between failure-related action control and performance ability, for the standard control group, warrants further research before conclusions, of any kind, can be drawn with empirical confidence.

Further bivariate correlation analyses revealed a significant and positive relationship between mean

difference scores of cognitive-related action control and composite performance ability, for the imagery control group ( $r = 0.59$ ,  $p < 0.044$ ). It may be speculated that the imagery control group may have had the capacity to stimulate high scores in cognitive-related action control which may have been positively associated with high scores in composite performance ability. This finding may be tentatively attributed to the nature and scope of the conventional imagery intervention which employed more cognitive-motor relaxation and mental imagery strategies as opposed to the standard control intervention which emphasised behavioural instruction, correction and execution.

In addition, numerous significant and near-significant bivariate correlation results suggested that the ability to image movements vividly was positively associated with the use of action control strategies, across pre- to post-intervention conditions, for the entire sample. In this regard, it was observed that the ability to image movements vividly from an external perspective may have been strongly and positively associated with cognitive manifestations of action control as well as with decision-related action control. Thus, it may be tentatively put forward that, across pre- to post-intervention conditions, the sample of subjects may have been more likely to develop a strong ability to image movements vividly from an external perspective which may have enabled them to be more decisive, i.e. action orientated (Kuhl, 1984).

In particular, the experimental imagery group revealed the existence of several highly significant and positive correlations between pre- and post-intervention scores of external vividness of movement imagery and action control; in particular, with decision-related action control. Thus, it may be tentatively put forward that both before and after the experimental imagery intervention ensued, high scores in external vividness of movement imagery may have been positively associated with high scores in decision-related action control, i.e. determinate versus vacillating decision making (Kuhl, 1984).

In this regard, it may be speculated that the experimental imagery intervention may have had the capacity to stimulate the ability to image movements vividly from an external perspective which may have enabled them to exercise greater personal commitment when intending to perform the motor task. This being the case, both before and after the instruction intervention procedure had ensued, subjects in the experimental imagery group may have been more externally orientated, less indecisive



(action orientated) and more prepared to engage with the successful performance of the activity (Kuhl, 1984).

Interestingly, a highly significant and positive correlation was observed between external vividness of movement imagery and failure-related action control, for the experimental imagery group, from pre- to post-intervention conditions ( $r = 0.65$ ,  $p < 0.022$ ). Thus, it may be tentatively put forward that the experimental imagery intervention may have had the capacity to promote high scores in external vividness of movement imagery which may have been positively associated with high scores in failure-related action control, i.e. ruminating about versus ignoring uncontrollable failure (Kuhl, 1984). This being the case, subjects in the experimental imagery group may have been encouraged to image movements vividly from an external perspective and to possibly ignore versus ruminate about uncontrollable failure (Kuhl & Eisenbeiser, 1986).

#### **5.4 Limitations of the study**

There are aspects of the present study which make it necessary to qualify conclusions drawn from the results. Thus, a brief discussion will be presented around some of the conceptual, methodological and research design problems inherent in this study. A review of the following research limitations may assist in facilitating theoretical and empirical investigation into this domain of research.

- ❑ The somewhat inconsistent and unexpected performance ability results of the study point to serious methodological, research design and logistical factors which may have confounded the results. Despite conducting the method of random assignment, parametric and nonparametric testing between the three groups for most of the vividness of movement and action control scales revealed substantial and sometimes significant pre-intervention differences in favour of the standard control group. Therefore, the imagery control group and, in particular, the experimental imagery group were found to be at a distinct disadvantage, prior to the intervention procedure. Furthermore, on the basis of initial qualitative data gathered from the administration of brief semi-structured interviews to the individual subjects, it would seem that subjects in the standard control differed markedly in intellectual ability and cognitive intelligence, relative to the other two groups. Therefore, in all probability, it follows that subjects also differed in level of imagery skill and ability.

- ❑ Secondly, due to limited subject availability, the sample of subjects were selected in the adolescent age (11 - 13 years) and stage of development. Despite controlling for age, gender, the onset of secondary sexual characteristics and level of performance skill, differing rates of biological growth and maturation in puberty (Beunen & Malina, 1996) resulted in a more heterogenous sample of subjects. Thus, the results of the study are viewed with extreme caution since inferences and comparisons cannot be drawn with empirical confidence.

Therefore, in view of the above two points, it may be argued that the absence of a pre-experimental subject screening, assessment and matching procedure may have contributed to the highly unexpected and negative results in performance ability for the two imagery groups.

- ❑ As discussed in section 5.2, the amount of training in the first phase of the experiment was not adequately controlled for, with assumptions being made that all participants were equally skilled in developing, controlling and using imagery. In this regard, the research design did not adequately consider the critical issue of whether subjects should be trained in imagery use, as proposed by Suinn (1993); how much time should be allocated to the practice of such imagery techniques; and whether this will affect the magnitude of mental practice effects. A related issue is the question of how many imagery practice sessions constitute a sufficient level. It is difficult to determine and, therefore, measure when a subject has reached an acceptable level of relaxation and an acceptable control of imagery in order to optimally profit from an imagery intervention. However, the current study's somewhat unexpected and inconsistent results suggest that a "once off approach" to imagery generation and application, particularly with adolescent children, may lead to a deterioration in performance ability. Thus, the length of mental imagery training may be an important variable to consider in future research and points strongly to the need for a longitudinal research design. However, logistical and cost limitations as well as the problem of subject attrition, need to be taken into account when implementing a experimental procedure of this magnitude within a longitudinal frame.

- ❑ The study's external validity is questionable. According to Murphy and Jowdy (1992), much of the literature on mental imagery is based on analogue research designs which presents a critical external validity problem for researchers. The current study utilised a sample of non-elite adolescent ballet dancers, exposed them briefly to imagery rehearsal techniques, and then proceeded to measure the effects of two alternative modes of imagery intervention on vividness of movement imagery, action control and performance ability. Thus, it is difficult to generalise from the current study to the sports population. For example, elite athletes are highly motivated to enhance their performance ability and would therefore be more diligent in the amount of time they give to the practice of cognitive strategies to better manage their performance tasks (Suinn, 1993). Having said this, the results of the current study may have yielded some important implications for further research in the field of imagery utilising non-elite young ballet dancers.

Furthermore, due to the study's small sample size, it is necessary to be cautious in interpreting the results, as the results cannot be generalised to the total population of athletic sports persons, but refer specifically to a non-elite population of adolescent ballet dancers. Moreover, it is possible that type II errors, failing to reject the null hypothesis when it is false, may have occurred. A larger sample would therefore have been preferable.

- ❑ Although some descriptive evidence that imagery ability plays an important role in sporting performance has been provided by several correlational studies, in evaluating this body of research, it is apparent that the correlational type of design comparing successful with unsuccessful competitors is one of the weakest used in the investigation of imagery in sport. Heyman (1982) has pointed out several problems with the research design and methodology of these studies. A central problem is that causality between certain cognitive strategies and performance is implied where none may exist. Furthermore, this type of research has little to say about *how* imagery processes might affect performances. According to Murphy and Jowdy (1992), the combined results of the research suggest that individual differences in imagery ability must certainly be considered by researchers who are investigating the performance effects of imagery-based strategies. Therefore, in light of the above reservations, the significant post-intervention correlations between measures of vividness of movement imagery and performance ability are interpreted with caution.

- ❑ Although the level of imagery ability is acknowledged by researchers as a factor which may affect the outcome of imagery intervention, a prime theoretical issue is whether imagery ability is innate or learnable (Suinn, 1993). It is not certain as to whether some individuals are incapable of developing and controlling imagery or whether it is conceivable that anyone can learn to develop and control imagery, if allowed sufficient training time in accordance with the correct training method. Therefore, for the purposes of extending and refining theoretical principles in this field, further quantitative and qualitative research in mental imagery in this regard, is necessary.

## 5.5 Recommendations for future research

Mental imagery is acknowledged by Perry and Morris (1995) as a rich and complex phenomenon and therefore deserves serious and careful exploration in future efforts in sport psychology. Several directions for future study emerged from the present research.

- ❑ The method of random assignment of subjects into three groups, may have been substantially refined and extended by conducting a pre-randomisation subject screening, assessment and matching procedure. By administering psychometric instruments prior to subject randomisation, unusually extreme values could be identified and screened out, thus yielding a more accurate picture of variability. Furthermore, the pre-randomisation subject screening procedure may have benefited from the selection of subjects on the partial basis of academic merit. For example, it may have been worthwhile to screen out subjects with unusually extreme English and Maths marks. This line of thought is supported by Howell (1997): “The range suffers, however, from a total reliance on extreme values, or, if the values are *unusually* extreme, on outliers. As a result, the range may give a distorted picture of variability” (p.42). Therefore, the method of random assignment of subjects into three groups may have been better executed based on a more identifiable and accurate range of subject characteristics.

For purposes of future research, other important factors such as developmental age and stage, weight and height, level of performance skill, intellectual ability, imagery ability, need to be adequately controlled for by including a pre-experimental subject screening, assessment and matching procedure. In particular, it may be preferable to set up matched triplets of subjects matching on a selection of variables such as initial ability level of physical performance and

imaging skills. Thus, a more refined methodology and research design may be critical in controlling pre-intervention within- and between-subject variability.

- According to Suinn (1993), using mental imagery appropriately is a type of mental skill. Thus, if imagery, as a tool for performance enhancement, is to have maximal effects, adequate skill development is necessary. Therefore, it is argued that a longitudinal research design would have better facilitated the development and refinement of imagery rehearsal as a mental skill over time. This being the case, it is predicted that the long-term effects of the experimental imagery intervention would have resulted in positive and significant effects in performance ability, relative to the other two groups. Although a follow-up experiment was originally proposed, budget and practical constraints precluded the implementation of a longitudinal research design of this magnitude.
- Based on the results of the study, it may be argued that future research efforts in the field of imagery generation and application may benefit from pre- and post-intervention assessments of arousal and anxiety levels as related to measures of action control and performance ability. According to Kuhl and Grosse (1983), high test anxiety seems to be associated with a low score for failure-related action control. Furthermore, according to Hinshaw (1991), when an individual has failed to establish his/her “ideal performing state” (incorporating appropriate personal levels of anxiety, stress and arousal), mental practice may not be at a maximum effectiveness (p.7). Furthermore, an individual at a less than ideal level of arousal is likely to have poor feelings of self-efficacy (Bandura, 1982; Perry & Morris 1995; van der Westhuizen & Basson, 1997). It follows that the abovementioned factors are likely to negatively impact on performance ability and should be adequately controlled for in future research.
- On reflection of the current study, it was speculated that the performance domain (classical ballet) and the corresponding task of choice (single *pirouette en dehors*) may have been limited in their ease of recognition, utility and interaction by the subjects during the imagery intervention. For the purposes of future research, it is speculated that more obvious and identifiable affordances and constraints could be offered by alternative contexts and corresponding tasks, such as swimming and squash. Ecological self imagery used with an elite swimmer will be used to demonstrate this

point (Basson, 1999a). Firstly, an aspect of the swimmer's gear that enhanced a sense of self as elite swimmer was selected. This included the feel of the bathing costume, its snug defining fit, swimming goggles, headgear etc. Secondly, to locate and define self in relation to planes and surfaces of the swimming pool and its surrounds, the sights, sounds and physical boundaries of a familiar swimming pool were used in imagery generation. Finally, relevant physical affordances and constraints relative to the motor action of swimming were generated and highlighted, such as the lane float markers, the starting blocks, the walls/ends of the pool and the supportive resistance of the water. Another more appropriate performance context for the generation and application of ecological self imagery is that of squash (Basson, 1999b). An example of affordances and constraints in this context could be the striking surface of the racquet that enables the player to direct the ball to a particular affording and constraining wall surface, at a particular angle. In view of the above examples, it may be speculated that the domain of classical ballet and the motor task of a single *pirouette en dehors* may have offered less obvious affordances with which the subjects could easily identify and interact during the imagery intervention. Thus, it may be useful to conduct a series of comparative studies aimed at comparing the results of studies yielding more explicit affordance contexts (e.g. squash and swimming) with those yielding more implicit affordance contexts (e.g. classical ballet, figure skating).

## CHAPTER SIX

### SUMMARY OF STUDY AND CONCLUSIONS

The results of this study were somewhat unexpected and inconsistent. In this regard, performance ability measures failed to support the study's principle research hypothesis. The standard control group revealed a significant and positive improvement in performance ability, relative to the two imagery groups. Surprisingly, both the imagery control and experimental imagery groups revealed significant and deleterious effects in performance ability.

The abovementioned unexpected and inconsistent results in performance ability point strongly to several problems inherent in the research design, methodology and logistics of the research. In particular, despite conducting a pre-experimental randomisation procedure, the standard control group was found to be significantly different from the two imagery groups, for pre-intervention measures of external vividness of movement imagery and cognitive-related action control. These significant pre-intervention results highlight the need for a pre-experimental subject screening, assessment and matching procedure in order to present a more accurate picture of variability (Howell, 1997). As a probable consequence of the standard control group's significant pre-intervention scores for external vividness of movement imagery and cognitive-related action control, the standard control group was found to be significantly different from the two imagery groups, on the abovementioned scales, after the intervention procedure had ensued.

It may be further argued that the inconsistent results in performance ability were confounded by the concern that the sample of subjects was drawn from a population of young (11- 13 years) ballet dancers in the highly variable stage of adolescence. In this regard, subjects of a similar chronological age were found to differ markedly in terms of physical maturation, weight, height, level of performance skill, intellectual ability, cognitive intelligence and imagery ability. Therefore, despite the relatively narrow range in subject age (11 - 13 years), it may be argued that chronological age, as an indicator of individual maturity status, had limited utility for the current study.

In support of secondary research hypothesis 2, nonparametric testing revealed that the experimental imagery group ranked significantly higher than the imagery control group on mean difference scores of internal vividness of movement imagery. This result suggests that ecological self imagery may

have had the capacity to stimulate internal imaging ability to a greater extent than a conventional imagery intervention. The majority of literature supports the premise that mental practice works best when using images from an internal perspective (Hinshaw, 1999). However, the results of this study emphasise the need for future research in the field of imagery generation and application.

Additional investigations into the nature and direction of the relationships between performance ability, vividness of movement imagery and action control revealed the existence of numerous significant and near-significant associations. In particular, significant and positive correlations were found between vividness of movement imagery and performance ability, for the entire sample and for each group. Furthermore, two stepwise multiple regression procedures revealed that post-intervention measures of external vividness of movement imagery strongly predicted post-intervention measures of performance ability for the entire sample, while post-intervention measures of internal vividness of movement imagery strongly predicted post-intervention measures of performance ability across the two imagery groups ( $N = 24$ ). The above results contribute to the existing scientific experimental evidence which clearly demonstrates the value of imagery in learning and performing motor skills (Cox, 1994; Perry & Morris, 1995; Solso, 1979; Suinn, 1993; Suler, 1996; Weinberg & Gould, 1995). However, Murphy and Jowdy (1992) argue that studies of the imagery-performance relationship have generated many more questions than have been answered. Furthermore Heyman (1982), strongly cautions against drawing causal inferences from a correlational research design.

Interestingly, bivariate correlation results revealed the existence of a highly significant and inverse relationship between failure-related action control and performance ability, from pre- to post-intervention conditions, for the standard control group. Furthermore, bivariate correlation results suggested the existence of significant and near-significant positive associations between cognitive-related action control and performance ability, from pre- to post-intervention conditions, for the imagery control group. However, the nature and direction of the relationship between action control and performance ability warrants further exploration before conclusions, of any kind, can be drawn.

Furthermore, numerous significant and positive associations were found between measures of external vividness of movement imagery and action control for the entire sample and, in particular,



the experimental imagery group. Thus, it may be tentatively put forward that the ability to image movements vividly from an external perspective may be positively associated with the use of action control strategies. Furthermore, it was observed that correlations observed between external vividness of movement imagery and action control for the experimental imagery group were the strongest obtained for the current study. It is therefore the submission of the investigator that the relationship between imagery ability and action control deserves further investigation within the context of ecological self imagery research.

Although the current study was beset with methodological, research design and logistical problems, it is nevertheless suggested that ecological self representation, as a context variable in an imagery intervention, may play an important and significant role in enhancing action control and performance ability. Ecological self representation may therefore be considered both a valuable added dimension to, and refinement of, future imagery interventions in sport. The results of the current study will hopefully provide impetus for the investigation of other potential context variables in imagery interventions and so reveal more of the unknown, but rich and complex processes, of imagery in sport psychology.

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**GLOSSARY OF FRENCH TERMS**

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<i>Devant or En Face</i>	Front
<i>En Avant</i>	Towards the front
<i>Croisé en Avant</i>	Towards the closed front corner
<i>Ouvert en Avant</i>	Towards the open front corner
<i>Devant Croisé</i>	Facing the closed front corner
<i>Devant Overt</i>	Facing the open front corner
<i>De Cote</i>	To the side
<i>Derrière</i>	Back
<i>En Arrière</i>	Towards the back
<i>Croisé en Arrière</i>	Towards the closed back corner
<i>Ouvert en Arrière</i>	Towards the open back corner
<i>Derrière Croisé</i>	Facing the closed back corner
<i>Derrière Ouvert</i>	Facing the open back corner
<i>Ecarte</i>	Facing the diagonal

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## APPENDIX B

**THE BIOGRAPHICAL INFORMATION QUESTIONNAIRE (BIQ)**


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In order to conduct this study, it is necessary to secure dancers who are of a similar age, skill, ability and stage of development. Therefore, please ensure that you complete the following questions and statements as accurately as possible. Although some of information may be of a very personal nature, please be reassured that all information is treated as highly confidential and will be strictly used for the purposes of the experimental procedure. The findings of this study will be used to advance research and practice into sport psychology, particularly in the field of mental imagery.

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**Biographical Information**

Name: .....

Age: .....

Date of birth: .....

Address: .....

Contact telephone number: .....

**Specifying information**

Briefly answer the following:

1. Have you been taught how to do a single *pirouette en dehors* yet ? .....
2. Have you learned to do a double *pirouette en dehors* yet ? .....
3. What method of ballet have you been trained in (eg: RAD, Cecchetti, Imperial) ? .....
4. How many years have you been engaged in the study of classical ballet ? .....



5. How many days per week do you attend ballet classes (on average) ? .....
6. How many hours per day do you practice (on average) ? .....
7. State your most recent grade qualification (e. g. Grade 4, Grade 5, etc) .....
8. State the result obtained for the above mentioned qualification (e.g. Pass, Commended, Highly Commended, etc) .....

**Personal information****STRICTLY CONFIDENTIAL**

1. What grade are you in at school ? .....
2. Have you started menstruation ? .....
3. Please indicate with a tick (Yes) or a cross (No), in the Answer column, below whether you have developed any of the following secondary sexual characteristics:

**Character****Answer (✓ or ×)**

Breasts	
Wider hips with femurs converging to knee	
Pubic hair	

## APPENDIX C

**THE VIVIDNESS OF MOVEMENT IMAGERY QUESTIONNAIRE (VMIQ)**

Movement imagery refers to the ability to imagine a movement. The aim of this questionnaire is to determine the vividness of your movement imagery. The items of the test are designed to bring certain images to your mind. You are asked to rate the vividness of each item by reference to the 5-point scale. After each item, write the appropriate number in the box provided. The first box is for an image obtained watching somebody else and the second box is for an image obtained doing it yourself. Try to do each item separately, independently of how you may have done other items.

Complete all items obtained **Watching somebody else** and then return to the beginning of the questionnaire and rate the image obtained **Doing it yourself**. The two ratings for a given item may not in all cases be the same. For all items please have your eyes **CLOSED**.

Think of each of the following acts, and classify the images according to the degree of clearness and vividness as shown on the **RATING SCALE**

ITEM		Watching somebody else	Doing it yourself
1	Standing		
2	Walking		
3	Running		
4	Jumping		

**RATING SCALE**

The image aroused by each item might be:

Perfectly clear and as vivid as normal vision ..... **RATING 1**  
 Clear and reasonably vivid ..... **RATING 2**  
 Moderately clear and vivid ..... **RATING 3**  
 Vague and dim ..... **RATING 4**  
 No image at all, you only "know" that you are thinking of the skill ..... **RATING 5**

Think of each of the following acts, classify the images according to the degree of clearness and vividness as shown on the RATING SCALE

ITEM		Watching somebody else	Doing it yourself
5	Reaching for something on tiptoe		
6	Drawing a circle on paper		
7	Kicking a stone		
8	Bending to pick up a coin		
9	Falling forwards		
10	Running up stairs		
11	Jumping sideways		
12	Slipping over backwards		

**RATING SCALE**

The image aroused by each item might be:

- Perfectly clear and as vivid as normal vision . . . . . RATING 1
- Clear and reasonably vivid . . . . . RATING 2
- Moderately clear and vivid . . . . . RATING 3
- Vague and dim . . . . . RATING 4
- No image at all, you only "know" that you are thinking of the skill . . . . . RATING 5

Think of each of the following acts, classify the images according to the degree of clearness and vividness as shown on the RATING SCALE

ITEM		Watching somebody else	Doing it yourself
13	Catching a ball with two hands		
14	Throwing a stone into water		
15	Kicking a ball in the air		
16	Hitting a ball along the ground		

ITEM		Watching somebody else	Doing it yourself
17	Running downhill		
18	Climbing over a high wall		
19	Sliding on ice		
20	Riding a bike		

---

**RATING SCALE**

The image aroused by each item might be:

Perfectly clear and as vivid as normal vision ..... **RATING 1**  
 Clear and reasonably vivid ..... **RATING 2**  
 Moderately clear and vivid ..... **RATING 3**  
 Vague and dim ..... **RATING 4**  
 No image at all, you only "know" that you are thinking of the skill ..... **RATING 5**

---

Think of each of the following acts, classify the images according to the degree of clearness and vividness as shown on the RATING SCALE

ITEM		Watching somebody else	Doing it yourself
21	Jumping into water		
22	Swinging on a rope		
23	Balancing on one leg		
24	Jumping off a high wall		

---

**RATING SCALE**

The image aroused by each item might be:

Perfectly clear and as vivid as normal vision ..... **RATING 1**  
 Clear and reasonably vivid ..... **RATING 2**  
 Moderately clear and vivid ..... **RATING 3**  
 Vague and dim ..... **RATING 4**  
 No image at all, you only "know" that you are thinking of the skill ..... **RATING 5**

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### THE ACTION CONTROL SCALE (ACS)

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The Action Control Scale consists of three subscales:

- 1 Performance-related action vs. state orientation (AOP) (i.e. activity vs. goal orientation)
- 2 Failure-related action vs. state orientation (AOF)
- 3 Decision-related action vs. state orientation (AOD)

Each subscale contains 20 items. Each item specifies a situation and two response alternatives, one indicating an action oriented and the other one indicating a state oriented response. Each subscale contains ten items assessing *behavioural* manifestations of action and state orientations and ten items assessing *cognitive* manifestations

For most experimental purposes, it has proven useful to combine the cognitive and the behavioural items. The three scores for *AOP*, *AOF*, and *AOD* are computed by summing up all action-oriented answer alternatives endorsed by the subject, separately for each scale. In a recent study ( $n = 115$ ), the following estimates of internal consistency (Cronbach's alpha) have been obtained: .74 (*AOF*): .79 (*AOF*) and .79 (*AOD*).

The action-oriented response alternatives are:

<i>AOP</i> (behavioral):	2a, 3a, 4b, 8b, 9a, 10b
(cognitive):	12a, 13b, 15a, 17a, 19b, 20b
<i>AOF</i> (behavioral):	2a, 3b, 6b, 7b, 8b, 10a
(cognitive):	11b, 12b, 13a, 15b, 16a, 17b
<i>AOD</i> (behavioral):	3b, 4a, 5a, 7a, 8b, 10b
(cognitive):	14b, 15b, 16a, 17b, 18a, 19b

Correlations between *AO*-scores and several personality variables indicated the theoretically expected overlap with test anxiety, extraversion, self-consciousness, achievement motivation, future orientation, and cognitive complexity (see Kuhl, 1984). The moderate size of these correlations ( $<1.36$ ), however, indicates that a substantial proportion of variance in action-orientation scores cannot be accounted for by any of the personality variables mentioned earlier.

---

**Performance-related action control (AOP)**

- (1) When I've done extremely well in an important contest
  - (a) I'd like best to continue
  - (b) I then like to do completely different things
- (2) When I receive an award for excellent achievement
  - (a) I like to continue practising in the same area immediately
  - (b) I like to do things that have nothing to do with this area
- (3) When I've finished an excellent piece of work
  - (a) I like to do something else for a while
  - (b) it makes me want to do some more in the same area
- (4) When I'm reading something interesting
  - (a) I busy myself with other things sometimes for a change
  - (b) I often stick with it for a long time
- (5) When the TV schedule seems interesting to me
  - (a) I watch one program after the other
  - (b) I soon need to change anyway
- (6) When I do something interesting with friends
  - (a) I soon get interested in something else anyway
  - (b) I'd rather not stop with what we're doing
- (7) If I get lucky in a situation where my chances were poor
  - (a) I play it back in my mind over and over again
  - (b) it's not long before I think about other things

- (8) When I've accomplished something really important
    - (a) I think about other things relatively soon
    - (b) I can't think about anything else at first
  - (9) When I try something new and I'm successful with it
    - (a) I keep thinking of it for a while
    - (b) I think about something else after a little while
  - (10) When somebody surprises me with a gift that really pleases me
    - (a) I think about the nice surprise for a long time
    - (b) I soon busy myself with other things after the initial surprise is over
  - (11) When I really liked a vacation
    - (a) I busy myself with other things soon after I return
    - (b) after my return, I think a lot about the vacation
  - (12) If someone has irritated me and I really told him off
    - (a) then the matter is finished for me
    - (b) the feeling of satisfaction stays with me for quite a while
- 

#### **Failure-related action control (AOF)**

- (1) When my work is labelled "unsatisfactory"
  - (a) then I really dig in
  - (b) at first I am stunned
- (2) When I notice that I'm not getting anywhere with something important
  - (a) it kind of cripples me
  - (b) I lay it aside for a while and do something else
- (3) When grades do not match the effort I put into a task
  - (a) it takes a while before I get over the disappointment
  - (b) I then work extra hard
- (4) When something important to me just keeps going wrong
  - (a) I gradually get discouraged
  - (b) I forget about it for a while and do something else

- (5) When something makes me sad
    - (a) I lose all desire to do anything
    - (b) I try to divert my attention to other things
  - (6) When my whole ambition is to finish something successfully and it doesn't work out
    - (a) I would like to start the whole thing over again from the beginning
    - (b) it's hard for me to do anything at all
  - (7) If I lost something of value and all efforts to find it proved futile
    - (a) I would have a hard time getting over it
    - (b) I wouldn't think about it very long
  - (8) When I'm lagging far behind in a contest of some sort
    - (a) I think about how I can make the best of the situation
    - (b) I think about whether or not I might make a fool of myself
  - (9) If somebody is unfriendly to me
    - (a) it can put me in a bad mood for quite a while
    - (b) it doesn't bother me for long
  - (10) When I'm in pain
    - (a) I am able to concentrate on other things
    - (b) I can hardly think about anything else
  - (11) When I'm taking an important test and I notice that I'm not doing too well
    - (a) it gets harder and harder for me to concentrate on the questions
    - (b) I don't think much about it until the test is over
- 

**Decision-related action control (AOD)**

- (1) When I have a lot of important things to take care of
  - (a) I often don't know where to start
  - (b) It is easy for me to make a plan and then stick to it
- (2) When I have two things that I would like to do and can do only one
  - (a) I decide between them pretty quickly
  - (b) I wouldn't know right away which was most important to me



- (3) When I have to do something important that's unpleasant
  - (a) I'd rather do it right away
  - (b) I avoid doing it until it's absolutely necessary
- (4) When I have to complete a difficult assignment
  - (a) I can concentrate on the individual parts of the assignment
  - (b) I easily lose my concentration on the assignment
- (5) When I fear that I'll lose interest during a tedious assignment
  - (a) I complete the unpleasant things first
  - (b) I start with the easier parts first
- (6) When I've planned to do something unfamiliar in the following week
  - (a) it can happen that I change my plans at the last moment
  - (b) I stick with what I've planned
- (7) When I have a hard time getting started on a difficult problem
  - (a) the problem seems huge to me
  - (b) I think about how I can get through the problem in a fairly pleasant way
- (8) When I have to solve a difficult problem
  - (a) I think about a lot of different things before I really start on the problem
  - (b) I think about which way would be best to try first
- (9) When I'm trying to solve a difficult problem and there are two solutions that seem equally good to me
  - (a) I make a spontaneous decision for one of the two without thinking much about it
  - (b) I try to figure out whether or not one of the solutions is really better than the other
- (10) When I have to study for a test
  - (a) I think a lot about where I should start
  - (b) I don't think about it too much; I just start with what I think is most important
- (11) When I've made a plan to learn how to master something difficult
  - (a) I first try it out before I think about other possibilities
  - (b) before I start, I first consider whether or not there's a better plan

- (12) When I'm faced with the problem of what to do with an hour of free time
- (a) sometimes I think about it for a long time
  - (b) I come up with something appropriate relatively soon
-

**PERFORMANCE SKILL EVALUATION CHART (PSEC)**

**RATING SCALE:**

- ☐ **VERY SUPERIOR..... 6 POINTS**  
This *pirouette en dehors* fulfills all the criteria and is perfectly executed
- ☐ **SUPERIOR ..... 5 POINTS**  
This *pirouette en dehors* fulfills most of the criteria except one or two and is just less than perfect
- ☐ **HIGH AVERAGE ..... 4 POINTS**  
This is still a very good *pirouette en dehors* and fulfills more than half of the criteria
- ☐ **AVERAGE ..... 3 POINTS**  
This *pirouette en dehors* is not good but not bad either. It fulfills only half of the criteria
- ☐ **LOW AVERAGE ..... 2 POINTS**  
This *pirouette en dehors* fulfills less than half of the criteria and is executed quite badly
- ☐ **VERY POOR ..... 1 POINT**  
This *pirouette en dehors* fulfills one or two criteria and is very weak

**PIROUETTE EN DEHORS (right and left side)**

SECTION A	SCORE	
PREPARATION	RIGHT	LEFT
<ul style="list-style-type: none"><li>■ correct body alignment (torso, shoulders, hips, pelvis)</li><li>■ quality of lower turn-out</li><li>■ correct placement of body weight</li><li>■ correct placement of arms (too high, too low, too far behind)</li><li>■ correct placement of legs (turn out, too wide or narrow)</li><li>■ correct placement of feet (turnout, rolling arches)</li></ul>	<div></div>	<div></div>
<b>TOTAL SCORE (for office use only) =</b>		

**RATING SCALE:**

- ☐ **VERY SUPERIOR..... 6 POINTS**  
This *pirouette en dehors* fulfills all the criteria and is perfectly executed
- ☐ **SUPERIOR ..... 5 POINTS**  
This *pirouette en dehors* fulfills most of the criteria except one or two and is just less than perfect
- ☐ **HIGH AVERAGE ..... 4 POINTS**  
This is still a very good *pirouette en dehors* and fulfills more than half of the criteria
- ☐ **AVERAGE ..... 3 POINTS**  
This *pirouette en dehors* is not good but not bad either. It fulfills only half of the criteria
- ☐ **LOW AVERAGE ..... 2 POINTS**  
This *pirouette en dehors* fulfills less than half of the criteria and is executed quite badly
- ☐ **VERY POOR ..... 1 POINT**  
This *pirouette en dehors* fulfills one or two criteria and is very weak

**PIROUETTE EN DEHORS (right and left side)**

SECTION B	SCORE	
PIROUETTE POSITION DURING TURN	RIGHT	LEFT
<ul style="list-style-type: none"> <li>■ correct body alignment (torso, shoulders, hips, pelvis)</li> <li>■ quality of lower body turn-out</li> <li>■ correct placement of body weight</li> <li>■ correct placement of arms in <i>pirouette</i> position</li> <li>■ fully extended supporting knee</li> <li>■ placement of working leg and foot in <i>pirouette</i> position</li> </ul>	<div style="border: 1px solid black; width: 100px; height: 50px; margin: 0 auto;"></div>	<div style="border: 1px solid black; width: 100px; height: 50px; margin: 0 auto;"></div>
<b>TOTAL SCORE (for office use only)</b>		

**RATING SCALE :**

- ☐ **VERY SUPERIOR..... 6 POINTS**  
This *pirouette en dehors* fulfills all the criteria and is perfectly executed
- ☐ **SUPERIOR ..... 5 POINTS**  
This *pirouette en dehors* fulfills most of the criteria except one or two and is just less than perfect
- ☐ **HIGH AVERAGE ..... 4 POINTS**  
This is still a very good *pirouette en dehors* and fulfills more than half of the criteria
- ☐ **AVERAGE ..... 3 POINTS**  
This *pirouette en dehors* is not good but not bad either. It fulfills only half of the criteria
- ☐ **LOW AVERAGE ..... 2 POINTS**  
This *pirouette en dehors* fulfills less than half of the criteria and is executed quite badly
- ☐ **VERY POOR ..... 1 POINT**  
This *pirouette en dehors* fulfills one or two criteria and is very weak

**PIROUETTE EN DEHORS (right and left side)**

SECTION C	SCORE	
QUALITY OF ACTUAL TURN	RIGHT	LEFT
<ul style="list-style-type: none"> <li>■ adequate use of floor on " push off"</li> <li>■ quality of "spotting" with eyes and not head</li> <li>■ quality of <i>relevé</i> into pirouette position</li> <li>■ quality of movement control</li> <li>■ coordinated, smooth turn</li> <li>■ sense of balance (stays on same floor spot)</li> </ul>	<div style="border: 1px solid black; width: 100px; height: 100px; margin: 0 auto;"></div>	<div style="border: 1px solid black; width: 100px; height: 100px; margin: 0 auto;"></div>
<b>TOTAL SCORE (for office use only)</b>		

**RATING SCALE:**

- ☐ **VERY SUPERIOR..... 6 POINTS**  
This *pirouette en dehors* fulfills all the criteria and is perfectly executed
- ☐ **SUPERIOR ..... 5 POINTS**  
This *pirouette en dehors* fulfills most of the criteria except one or two and is just less than perfect
- ☐ **HIGH AVERAGE ..... 4 POINTS**  
This is still a very good *pirouette en dehors* and fulfills more than half of the criteria
- ☐ **AVERAGE ..... 3 POINTS**  
This *pirouette en dehors* is not good but not bad either. It fulfills only half of the criteria
- ☐ **LOW AVERAGE..... 2 POINTS**  
This *pirouette en dehors* fulfills less than half of the criteria and is executed quite badly
- ☐ **VERY POOR ..... 1 POINT**  
This *pirouette en dehors* fulfills one or two criteria and is very weak

**PIROUETTE EN DEHORS (right and left side)**

SECTION D	SCORE	
COMPLETION OF PIROUETTE EN DE DEHORS	RIGHT	LEFT
<ul style="list-style-type: none"> <li>■ correct body alignment (en face, square shoulders, hips)</li> <li>■ quality of lower body turn-out</li> <li>■ correct placement of body weight</li> <li>■ correct placement of arms in <i>bras bas</i> to finish</li> <li>■ correct placement of legs and feet in 5th position</li> <li>■ coordinated, smooth finish</li> </ul>	<div style="border: 1px solid black; width: 100px; height: 100px; margin: 0 auto;"></div>	<div style="border: 1px solid black; width: 100px; height: 100px; margin: 0 auto;"></div>
<b>TOTAL SCORE (for office use only)</b>		

**TECHNICAL INSTRUCTIONS FOR STANDARD CONTROL GROUP**

(compiled and administered by independent RAD teacher and examiner, 1999)

---

*Pirouette en dehors* on the right side

(a) Preparation: *Pirouette en dehors*

- ☐ Face directly and squarely to the front wall (*enface*)
- ☐ Stance with your feet in the 5<sup>th</sup> position (right foot in front)
- ☐ Start with your arms in *bras bas*
- ☐ *Dégagé* to 2<sup>nd</sup> position with the working leg
- ☐ Place your working foot in the 4<sup>th</sup> position *derrière*
- ☐ *Demi plie* in 4<sup>th</sup> position *derrière*
- ☐ Place your arms in 3<sup>rd</sup> position

(b) Turn: *Pirouette en dehors*

- ☐ *Relevé* from the *demi-plié* position into the *pirouette* position
- ☐ Execute a single *pirouette en dehors*
- ☐ Place the arms in 1<sup>st</sup> position during the *pirouette en dehors*

(c) Completion: *Pirouette en dehors*

- ☐ Close the right foot in 5<sup>th</sup> position *derrière*.
- ☐ Place the arms in *bras bas* to end the turn

*Repeat the pirouette en dehors* on the left side

---

## APPENDIX G

**IMAGERY SCRIPT FOR THE IMAGERY CONTROL GROUP****STANDARD RELAXATION AND IMAGERY**

(compiled and administered by Professor C J Basson, 1999)

**(a) *Relaxation***

Breathing exercises with associated spreading of energy to:

- ☐ shoulders, arms and hands
- ☐ shoulders back, buttocks, thighs, calves and feet
- ☐ focussing - light in the head and then to scan the full body to find areas of relaxation and tension
- ☐ further breathing and spreading from and to specific areas identified

**(b) *Imagery***

Personal relevant image to enhance relaxation:

- ☐ focus on colours, temperature, sound, other people
- ☐ select and identify a specific cue for easy access later

**(c) *General situatedness***

- ☐ Focus on the room that you are in as you stand in your own *spatial square*
- ☐ Specific focuses:
  - Positioning: general image of yourself ready to perform a *pirouette en dehors* - calm, relaxed and focussed
  - Image yourself as you *degagé* into *2<sup>nd</sup> position derrière* - hold your *demi-plie* - feeling relaxed and focussed ready to push off when you *pirouette en dehors*
  - Image a spot on the wall for your eyes to hold in focus for the *pirouette en dehors*
  - Image your chin parallel with the floor and your head steady
  - Image your eyes focussed on the spot on the wall as you snatch up and around, to perform a tightly controlled *pirouette en dehors* with your eyes focussed on the spot for the finish
  - Image clearly your working leg as you finish, and end in the *bras bas* position, smoothly and neatly in the *5<sup>th</sup> position derrière* in a well held *demi-plie* - feeling confident, focussed and relaxed

## APPENDIX H

**IMAGERY SCRIPT FOR EXPERIMENTAL IMAGERY GROUP**  
**STANDARD RELAXATION AND ECOLOGICAL SELF REPRESENTATIONAL IMAGERY**

(compiled and administered by Professor C J Basson, 1999)

---

(a) *Relaxation*

Breathing exercises with associated spreading of energy to:

- ☐ shoulders, arms and hands
- ☐ shoulders back, buttocks, thighs, calves and feet
- ☐ focussing - light in the head and then to scan the full body to find areas of relaxation and tension
- ☐ further breathing and spreading from and to specific areas identified

(b) *Imagery*

- ☐ Personal relevant image to enhance relaxation:
  - focus on colours, temperature, sound, other people
  - select and identify a specific cue for easy access later
- ☐ Ecological self: dressing, kit etc.
- ☐ Affordances and abilities

(c) *General situatedness:*

- ☐ Focus on the room that you are in as you stand in your own *spatial square*
- ☐ Trace in your mind the walls in front, at the side and behind, ceiling above, floor under your feet - surfaces, angles, slopes, solidness, supportiveness
- ☐ Specific focuses:
  - Image the pressure of your front foot on the supportive floor and yourself in relation to the front wall and ceiling - as you *degagé* into 2<sup>nd</sup> *position* - feel the breadth and expanse of your own spatial square
  - Image yourself using the floor's supportive surface to place your *working foot* in the 4<sup>th</sup> *position derrière* - hold your *demi-plie* - feeling supported by the flat floor and the surfaces of the walls around you - ready to use the solid surface of the floor that allows you to push off when you *pirouette en dehors*



- Image a spot on the wall - get a sense of your position in relation to the spot as your eyes focus on it - image the solid wall surface holding the spot, the surface of the wall, where it contacts the floor - holding the spot for when you finish the *pirouette en dehors*
  - Image your chin parallel to the flat surface of the floor and your head steady in relation to the flat ceiling
  - Image your eyes focussed on the spot on the wall surface as you snatch up and around. Feel the solidness of the floor under your feet allowing you to push off with gentle energy to perform a tightly controlled *pirouette en dehors*. Hold your eyes on the spot on the flat surface of the front wall for as long as you can, before turning
  - Image the solid supportive surface of the floor ready for your working leg to finish on as you end in the *bras bas* position facing the front wall, move in the 5<sup>th</sup> *position derrière* in a well held *demi-plie*. Sense and picture yourself in relation to the surfaces and angles of the walls in the room, the floor and the ceiling
-

**KEY OF ABBREVIATIONS**

The key below gives a description of the abbreviations that will be used throughout the results section:

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<b>M</b>	=	Mean
<b>SD</b>	=	Standard Deviation
<b>(d)</b>	=	Difference
<b>N</b>	=	36
<b>n</b>	=	12
<b>BIQ</b>	=	Biographical Information Questionnaire
<b>PSEC</b>	=	Performance Skill Evaluation Chart
<b>VMIQ</b>	=	Vividness of Movement Imagery Questionnaire
<b>ACS</b>	=	Action Control Scale
<b>AOP</b>	=	Performance-related action vs state orientation
<b>AOD</b>	=	Decision-related action vs state orientation
<b>AOF</b>	=	Failure-related action vs state orientation

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## APPENDIX L

### Table 17

[illegible]

## APPENDIX M

Table 18

CORRELATION COEFFICIENTS FOR THE VIVIDNESS OF MOVEMENT IMAGERY QUESTIONNAIRE (VMIQ) AND THE PERFORMANCE SKILL EVALUATION CHART (PSEC) FOR ENTIRE THE SAMPLE (N = 36)		
POST-INTERVENTION	Performance ability (PSEC)	
Composite VMIQ	$r = 0.46^{**}$	$p < 0.005$
External VMIQ	$r = 0.44^{**}$	$p < 0.007$
Internal VMIQ	$r = 0.43^{*}$	$p < 0.010$
* Correlation is significant at the 0.05 level of probability (2-tailed)		
** Correlation is significant at the 0.01 level of probability (2-tailed)		

Table 19

CORRELATION COEFFICIENTS FOR THE VIVIDNESS OF MOVEMENT IMAGERY QUESTIONNAIRE (VMIQ) AND THE PERFORMANCE SKILL EVALUATION CHART (PSEC) FOR EACH GROUP (n = 12)		
STANDARD CONTROL (n=12)		
PRE- TO POST- INTERVENTION	Performance ability (PSEC)	
Composite VMIQ	$r = - 0.54$	$p < 0.069$
External VMIQ	$r = - 0.61^{*}$	$p < 0.035$
IMAGERY CONTROL (n=12)		
PRE-INTERVENTION	Performance ability (PSEC)	
Internal VMIQ	$r = 0.50$	$p < 0.097$
POST-INTERVENTION	Performance ability (PSEC)	
Internal VMIQ	$r = 0.60^{*}$	$p < 0.038$
PRE- TO POST- INTERVENTION	Performance ability (PSEC)	
External VMIQ	$r = 0.51$	$p < 0.094$
EXPERIMENTAL (n=12)		
POST-INTERVENTION	Performance ability (PSEC)	
Composite VMIQ	$r = 0.57$	$p < 0.06$
External VMIQ	$r = 0.53$	$p < 0.077$
PRE- TO POST- INTERVENTION	Performance ability (PSEC)	
External VMIQ	$r = 0.56$	$p < 0.059$
*Correlation is significant at 0.05 level of probability (2-tailed)		

Table 20

CORRELATION COEFFICIENTS FOR THE ACTION CONTROL SCALE (ACS) AND THE PERFORMANCE SKILL EVALUATION CHART (PSEC) FOR THE ENTIRE SAMPLE (N = 36)		
POST-INTERVENTION	Performance ability (PSEC)	
Subscale AOD	$r = 0.29$	$P < 0.081$
PRE- TO POST-INTERVENTION	Performance ability (PSEC)	
Cognitive ACS	$r = 0.29$	$p < 0.085$
Subscale AOD	$r = 0.28$	$p < 0.090$

Table 21

CORRELATION COEFFICIENTS FOR THE ACTION CONTROL SCALE (ACS) AND THE PERFORMANCE SKILL EVALUATION CHART (PSEC) FOR EACH GROUP (n = 12)		
STANDARD CONTROL (n=12)		
PRE- TO POST- INTERVENTION	Performance ability (PSEC)	
Subscale AOF	$r = - 0.64^*$	$p < 0.027$
IMAGERY CONTROL (n=12)		
PRE- TO POST- INTERVENTION	Performance ability (PSEC)	
Composite ACS	$r = 0.50$	$p < 0.090$
Cognitive ACS	$r = 0.59^*$	$p < 0.044$
*Correlation is significant at 0.05 level of probability (2-tailed)		

CORRELATION COEFFICIENTS FOR THE VIVIDNESS OF MOVEMENT IMAGERY QUESTIONNAIRE (VMIQ) AND THE ACTION CONTROL SCALE (ACS) FOR THE ENTIRE SAMPLE (N = 36)						
PRE-INTERVENTION	Composite VMIQ		External VMIQ		Internal VMIQ	
Composite ACS	r=0.52**	p<0.001	r=0.50**	p<0.002	r=0.45**	p<0.006
Behavioural ACS	r=0.40*	p<0.015	r=0.29	p<0.087	r=0.44**	p<0.007
Cognitive ACS	r=0.48**	p<0.003	r=0.55**	p<0.001	r=0.34*	p<0.041
Subscale AOD	r=0.49**	p<0.002	r=0.43**	p<0.009	r=0.47**	p<0.004
Subscale AOF	r=0.37*	p<0.026	r=0.40*	p<0.017	r=0.29	p<0.085
POST-INTERVENTION	Composite VMIQ		External VMIQ		Internal VMIQ	
Composite ACS	r=0.37*	p<0.025	r=0.41*	p<0.012	r=0.30	p<0.074
Behavioural ACS	r=0.37*	p<0.026	r=0.36*	p<0.034	r=0.35*	p<0.039
Cognitive ACS	...		r=0.35*	p<0.034	...	
Subscale AOD	r=0.41*	p<0.014	r=0.50**	p<0.002	r=0.29	p<0.091
PRE- TO POST-INTERVENTION	Composite VMIQ		External VMIQ		Internal VMIQ	
Cognitive ACS	r=0.33*	p<0.047	r=0.41*	p<0.012	...	...
Subscale AOD	...	...	r=0.30	p<0.072	...	...

\* Correlation is significant at the 0.05 level of probability (2-tailed)  
 \*\* Correlation is significant at the 0.01 level of probability (2-tailed)



**Table 23**

CORRELATION COEFFICIENTS FOR THE VIVIDNESS OF MOVEMENT IMAGERY QUESTIONNAIRE (VMIQ) AND THE ACTION CONTROL SCALE (ACS) FOR EACH GROUP (n = 12)							
STANDARD CONTROL (n=12)							
PRE-INTERVENTION	Composite VMIQ		External VMIQ		Internal VMIQ		
Behaviour ACS	...		...		r = 0.54	p<0.070	
Subscale AOD	r = 0.53	p<0.078	r = 0.51	p<0.091	...		
POST-INTERVENTION							
Behavioural ACS	...		...		r = 0.52	p<0.084	
PRE- TO POST- INTERVENTION							
Cognitive ACS	...		r = 0.51	p<0.088	...		
IMAGERY CONTROL (n=12)							
PRE-INTERVENTION	Composite VMIQ		External VMIQ		Internal VMIQ		
Cognitive ACS	...		r = 0.50	p<0.097	...		
POST-INTERVENTION							
Subscale AOD	...		r = 0.53	p<0.074	...		
PRE- TO POST- INTERVENTION							
Subscale AOD	r = 0.51	p<0.092	r = 0.57	p<0.054	r = 0.52	p<0.084	
EXPERIMENTAL (n=12)							
PRE-INTERVENTION	Composite VMIQ		External VMIQ		Internal VMIQ		
Composite ACS	r = 0.52	p<0.084	r = 0.62*	p<0.031	...		
Behavioural ACS	r = 0.55	p<0.063	r = 0.62*	p<0.031	...		
Cognitive ACS	...		r = 0.59	p<0.045	...		
Subscale AOD	r = 0.63*	p<0.029	r = 0.64*	p<0.026	r = 0.55	p<0.064	
POST-INTERVENTION							
Composite ACS	...		r = 0.50	p<0.09	...		
Subscale AOD	r = 0.53	p<0.074	r = 0.65*	p<0.022	...		
PRE- TO POST-INTERVENTION							
Cognitive ACS	r = 0.54	p<0.068	r = 0.55	P<0.064	r = 0.51	P<0.088	
Subscale AOF	r = 0.62*	p<0.031	r = 0.65*	p<0.022	r = 0.57	p<0.053	

\* Correlation is significant at 0.05 level of probability (2-tailed)